

CALIFORNIA MUNICIPAL WASTEWATER RECLAMATION IN 1987



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California State Water Resources Control Board
Office of Water Recycling

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I. INTRODUCTION

California is facing an increasing water shortage. In 1985, the net annual water demand was 34.2 million acre-feet. A deficit of 2.0 million acre-feet in reliable supplies was met by overdrafting ground water. It is estimated that by the year 2010 the net demand will be 35.6 million acre-feet with the annual deficit increasing to about 2.3 million acre-feet. This assumes normal rainfall and completion of some of the currently proposed state and federal water development projects [1]. Increasing difficulties are being encountered in the development of new surface water supplies to meet the demand. The need to consider and develop long-term alternatives for water resources management is paramount in light of the increasing water shortage. Especially in the last decade wastewater reclamation has received much attention as a viable contribution to our water resources.

Wastewater reclamation is not new; the beneficial use of wastewater has been a practice in California since the 1890's, when raw sewage was in use on "sewer farms". Since then there has been a steady increase in reuse, amounting to over 266,000 acre-feet/year in 1987. Over the years various surveys have been conducted that have documented the increase, the last published survey covering the year 1977.

The purpose of this report is to provide detailed information and data on the planned reuse of treated municipal wastewater that occurred in 1987 in California. The data are derived from a comprehensive survey of municipal and other wastewater treatment plants. The survey was conducted in 1988 and 1989 by the Office of Water Recycling of the California State Water Resources Control Board (SWRCB). This report includes survey findings, a comparison with previous surveys, information on new wastewater reclamation projects since 1987, and survey procedure. Appendices contain the survey questionnaire, a list of all known municipal wastewater reclamation facilities, wastewater treatment requirements for reuse, a list of abbreviations used in this report and tables of conversion for units of measure. Unless otherwise noted, all data reported apply to the year 1987.

Terms regarding wastewater reclamation are not consistently used in the literature. Thus, the following definitions are used in this report:

"Reclaimed water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur [as defined in California Water Code, Section 13050(n)].

"Water or wastewater reclamation" includes the process of treating wastewater to produce water for beneficial use, the storage and distribution of reclaimed water to the place of use, and the actual use of reclaimed water.

"Planned reuse" is the deliberate direct or indirect use of reclaimed water without relinquishing control over the water during its delivery.

"Direct reuse" is use of reclaimed water that has been transported from a wastewater treatment plant to a reuse site without passing through a natural body of either surface or ground water.

"Indirect reuse" is the use of reclaimed water indirectly after it has passed through a natural body of water after discharge from a wastewater treatment plant.

"Municipal wastewater", for purposes of this report, is wastewater of domestic origin and of commercial, industrial, and governmental origin if such wastewater is commingled with domestic wastewater prior to treatment.

Planned ground water recharge with reclaimed water is considered in this report as a type of reuse, even though it is more correctly considered as only a temporary storage before actual indirect reuse takes place upon extraction from the ground. The percolation of effluent through rapid infiltration, as in ponds, intended primarily as a method of wastewater treatment and disposal, is not considered planned reuse. Unplanned indirect reuse of effluent percolated in stream beds constitutes a significant component of ground water supply for some communities, but this type of reuse is not within the purview of this report.

A distinction is made between land application of wastewater for the purpose of treatment or disposal and land application that results in water reclamation and reuse. These two categories are not mutually exclusive and are frequently overlapping. Land application is considered wastewater reuse as long as an intentional benefit results from the use of the reclaimed water. Beneficial uses may include, for example, irrigation of pasture or of crops that are harvested. Thus, insofar as a beneficial use is being derived, land treatment or disposal of wastewater is considered water reclamation, even though fresh water may not be replaced and irrigation methods may not be efficient with respect to crop needs.

In-plant use of treated effluent at wastewater treatment plants is common practice, such as for backwashing of filters, wash-down of equipment, and on-site landscape irrigation. The amounts used for in-plant purposes are often not measured and were only sporadically reported by the survey respondents. Thus, the amounts of treated wastewater used for in-plant reuse are not included in the data presented in this report, except for the separate discussion on in-plant reuse in Section II.

II. SURVEY FINDINGS

It was found from the survey that at least 266,559 acre-feet of municipal wastewater were beneficially reused in California in 1987. (As explained in Section V, perhaps as much as 2,000 acre-feet may be missing from this number.) Adjusting previously published data on wastewater production by population growth [2, 3], total municipal wastewater produced in California is estimated to have been between 3.4 and 3.9 million acre-feet in 1987. Thus, around 7 to 8 percent of municipal wastewater production was put to beneficial use. Other findings of the survey reported in this section include the distribution of reclaimed water amongst types of reuse and regions, freshwater savings, the value of the reclaimed water, levels of wastewater treatment provided, and in-plant reuse. A summary table of data collected on each water reclamation plant and user is presented in Appendix B. Other data were also collected, which cannot be conveniently presented in this report. The kinds of data collected are evident in the questionnaire used in the survey, which is shown in Appendix A. Also, some data were collected from respondents that did not fit within the scope of this report.

Types of Reclaimed Water Use

It was found that 200 water reclamation plants produced reclaimed water for distribution to at least 854 discrete use areas in 1987. Perhaps as many as 10 plants may be missing from these data. Also, the actual number of use areas was slightly higher because some use areas were consolidated as single users in reporting, such as several schools for a single school district. Reclaimed water has a wide variety of applications. The types of reuse are summarized in Table 1 and Figure 1. Much of the attention focused on reclaimed water over the last decade has been for its use in an urban context, such as for landscape irrigation, and its potential for ground water recharge. Nevertheless, the historical application for agricultural purposes continues to dominate, amounting to 63 percent of the total reclaimed water used in 1987.

Detailed descriptions of types of reclaimed water applications are provided in Appendix B. Some of the more uncommon uses are toilet flushing, fire protection, and leaching of soil salinity from agricultural fields. The largest industrial application of reclaimed water was for paper manufacturing. Other significant industrial uses were power plant cooling, watering of log decks, and cooling water in a steel manufacturing plant. One unique use was for cooling of a rocket testing platform. At least 20 different food crops were irrigated with reclaimed water, as well as at least 11 other crops and nursery products, as shown in Table 2.

Geographic Distribution of Reuse

The geographic distribution of reclaimed water use is shown in Table 3. The regions used for the distribution are the jurisdictional boundaries of the California Regional Water Quality Control Boards, which generally follow the major watersheds of the state, as shown in Figure 2. The Central Valley Region, also referred to as Region 5, is further broken down into the areas served by the three offices of that Regional Water Quality Control Board. As

Table 1
TYPES OF RECLAIMED WATER USE, 1987

Type of Reuse	Use Areas		Volume of Reclaimed Water	
	Number	Percent of total	Acre-feet/yr	Percent of total
Agricultural Irrigation:				
Harvested feed, fiber and seed crops	41	4.8	61,480	23.1
Pasture	56	6.5	20,175	7.6
Orchards and vineyards	11	1.3	5,037	1.9
Tree crops (Christmas trees, firewood, pulp, etc.)	4	0.5	75	<0.1
Nursery and sod crops	10	1.2	3,591	1.3
Food crops	5	0.6	3,780	1.4
Mixed, other or unknown types of agricultural products	113	13.2	72,179	27.1
Landscape Irrigation:				
Schools, playgrounds, parks where Title 22 tertiary effluent required	57	6.7	3,304	1.2
Freeway and highway landscape	17	2.0	870	0.3
Golf courses (including golf course impoundments)	63	7.4	15,197	5.7
Mixed, other or unknown types of landscape, (including street landscape, slope cover, parks where tertiary effluent not required)	433	50.7	11,464	4.3
Landscape Impoundments (excluding golf courses)	1	0.1	2,802	1.1
Recreational Impoundment	4	0.5	6,905	2.6
Wildlife Habitat Enhancement, Wetlands	5	0.6	9,773	3.7
Industrial Reuse:				
Cooling water	5	0.6	1,162	0.4
Process water	2	0.2	4,398	1.6
Construction, dust control, washdown	4	0.5	256	0.1
Other or unknown types of industrial reuse	1	0.1	218	0.1
Ground Water Recharge	7	0.8	38,585	14.5
Miscellaneous or unknown types of use or mixed types of above uses	15	1.7	5,308	2.0
Total	854	100.0	266,559	100.0

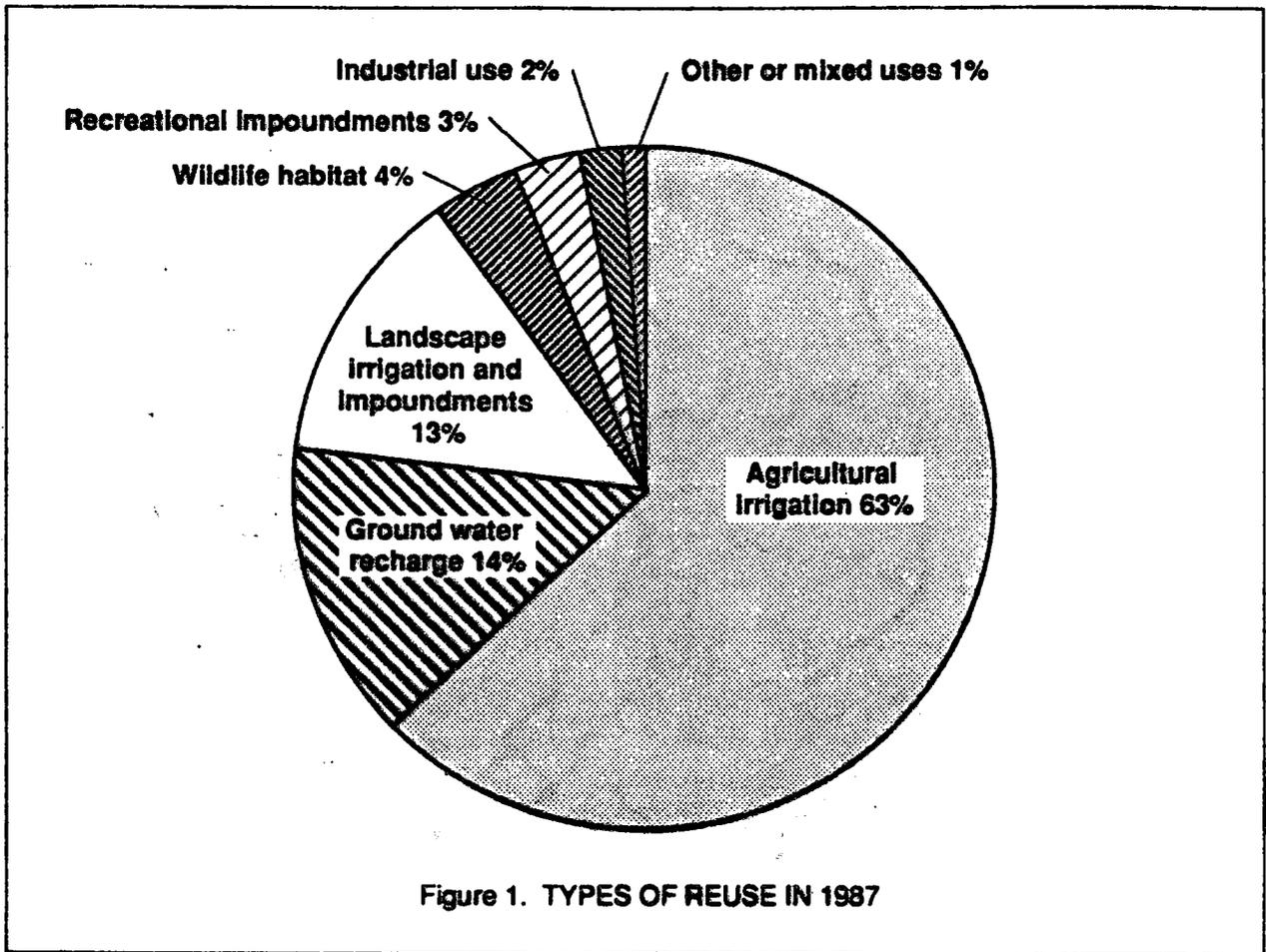


Table 2

TYPES OF CROPS IRRIGATED WITH RECLAIMED WATER

Food Crops		Non-food Crops
apples	corn	alfalfa
asparagus	grapes	Christmas trees
avocados	lettuce	clover
barley	peaches	corn
beans	peppers	cotton
broccoli	pistachios	eucalyptus trees
cabbage	plums	flower seeds
cauliflower	squash	hay
celery	sugar beets	sod
citrus	wheat	trees
		vegetable seeds

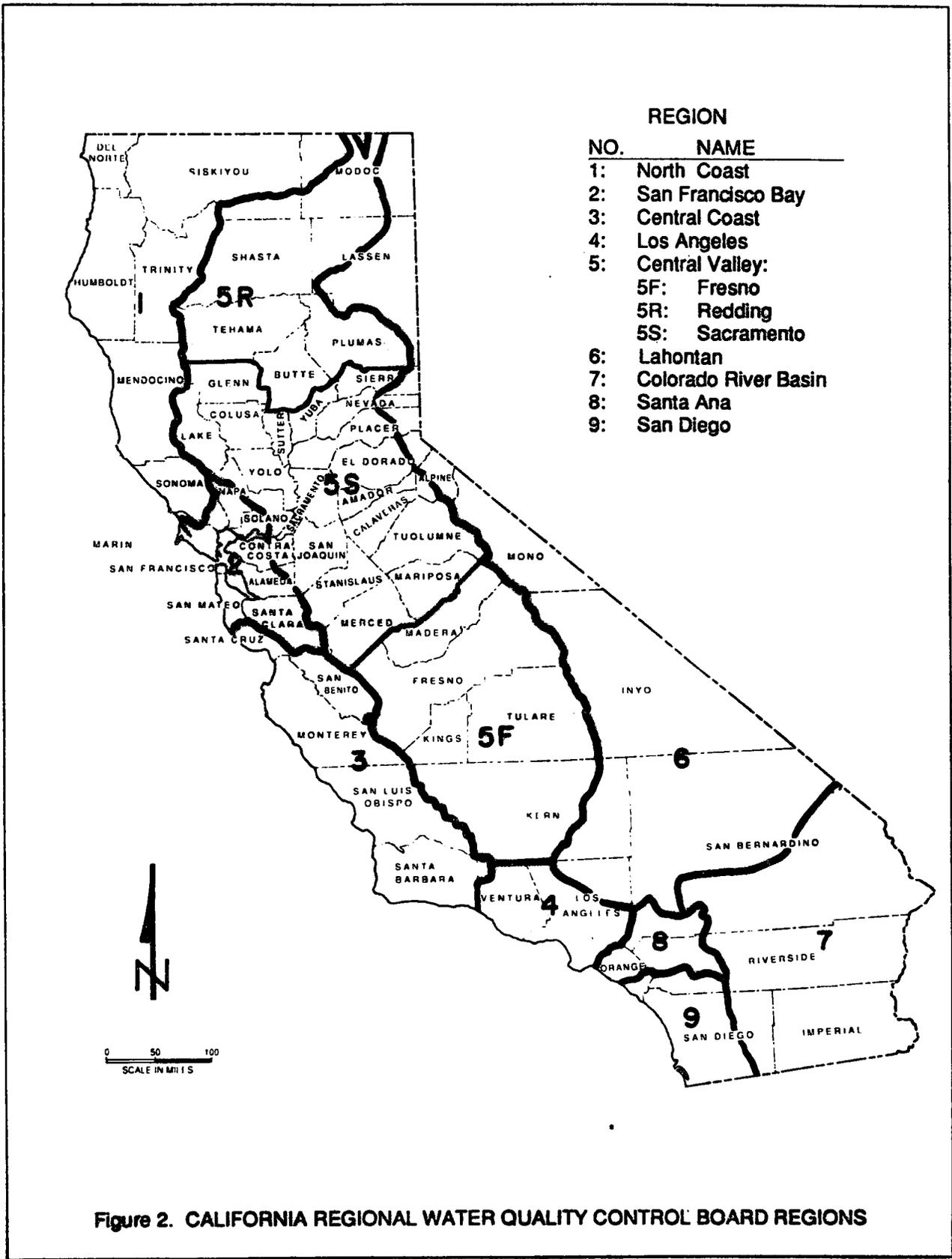


Table 3

REGIONAL DISTRIBUTION OF WATER RECLAMATION PLANTS,
RECLAIMED WATER USE AND RESULTING
FRESHWATER SAVINGS, 1987

Region	Number of Water Reclamation Plants	Freshwater Savings ^a , acre-feet/yr	Total Reclaimed Water Use	
			Volume, acre-feet/yr	Percent of total
1: North Coast	16	11,549	13,016	5
2: San Francisco Bay	18	3,899	11,010	4
3: Central Coast	15	5,895	6,141	2
4: Los Angeles	20	59,300	60,257	23
5: Central Valley:				
5F: Fresno	33	74,486	82,997	31
5R: Redding	6	567	792	<1
5S: Sacramento	33	25,910	32,077	12
6: Lahontan	17	6,138	18,024	7
7: Colorado River Basin	7	6,314	9,076	4
8: Santa Ana	18	26,473	27,280	10
9: San Diego	17	4,186	5,889	2
Total	200	224,717	266,559	100

^a Amounts of reclaimed water use reported to be replacing freshwater use.

would be expected, most of the reclaimed water use is in the Central Valley and the south coastal regions, amounting to 78 percent of the reclaimed water produced in California. The coastal areas from Santa Barbara County north and the desert and eastern Sierra Nevada regions used the remaining 22 percent. The Central Valley is dominated by agriculture, which is a readily accessible market that can use reclaimed water receiving relatively low levels of treatment. About half of the state's population resides in the south coastal regions of 4, 8 and 9. The dependence of the south coastal area on expensive imported water has created a higher demand for alternative sources of water, such as reclaimed water. However, despite a large metropolitan water demand in San Diego area, only 2 percent of reclaimed water use occurred there. Reuse has been approached cautiously in the San Diego area due to the concern of degrading small confined aquifers with excessive salts. Amendments to basin plans are currently being adopted by the Regional Water Quality Control Board of the San Diego Region, which are expected to result in a marked increase in the use of reclaimed water.

Size Distribution of Reclamation Systems

The size distribution of water reclamation systems is shown in Table 4. For the purpose of determining size distribution, a system is considered all of the water reclamation facilities related to a particular wastewater treatment plant. The measure of size is the total annual reclaimed water deliveries from each wastewater treatment plant. System sizes ranged from 0.6 acre-feet to 19,856 acre-feet delivered in 1987. Half of the total amount of reclaimed water was delivered by only a dozen of the state's 200 treatment plants, as listed in Table 5. While most systems have only one or two reclaimed water users, a few have quite elaborate pipeline distribution systems. Amongst the largest are the Irvine Ranch Water District, which had

Table 4
**SIZE DISTRIBUTION OF
 WATER RECLAMATION SYSTEMS**

Range of System Reclaimed Water Deliveries, acre-feet/yr	Wastewater Treatment Plants		Statewide Reclaimed Water Deliveries	
	Number	Percent of Total	Total, acre-feet/yr	Percent of Total
0 - 2,500	173	86	79,811	30
>2,500 - 5,000	15	8	53,780	20
>5,000 - 7,500	3	2	16,819	6
>7,500 - 10,000	4	2	35,502	13
>10,000 - 12,500	0	0	0	0
>12,500 - 15,000	2	1	28,086	11
>15,000 - 17,500	2	1	32,705	12
>17,500 - 20,000	1	<1	19,856	8
Total	200	100	266,559	100

Table 5
MAJOR WATER RECLAMATION SYSTEMS

Wastewater Treatment Plant Name	Reclaimed Water Deliveries, acre-feet/yr
1. San Jose Creek WRP	19,856
2. City of Bakersfield WTP #2	16,830
3. Whittier Narrows WRP	15,875
4. City of Modesto	14,390
5. Fresno-Clovis Metropolitan Area Regional Wastewater Facilities	13,696
6. Pomona WRP	9,598
7. Laguna TP	9,339
8. Michelson WRP	8,740
9. City of Bakersfield WTP #3	7,826
10. City of Tulare WPCF	6,248
11. Lancaster WRP	5,486
12. South Tahoe PUD STP	5,085
Total	132,969
Percent of Statewide Total	50

151 users in 1987, Las Virgenes Municipal Water District (133 users), Santa Margarita Water District (84 users), Los Alisos Water District (66 users), County Sanitation Districts of Los Angeles County (39 users at the Pomona plant and 25 users at the Long Beach plant), City of Santa Rosa (39 users at the Laguna plant), and Tuolumne Regional Water District (33 users receiving effluent from both the Sonora Regional and Jamestown Sanitary District plants).

Some agencies, either on their own or in cooperation with water districts or other water purveyors, have played a major role in developing the use of reclaimed water. Some of these operate more than one treatment plant producing reclaimed water for planned reuse. Among agencies operating wastewater treatment facilities, a dozen agencies provided 60 percent of the reclaimed water used statewide, as listed in Table 6.

Table 6

MAJOR RECLAIMED WATER PRODUCING AGENCIES

Agency	Number of Plants	Reclaimed Water Deliveries, acre-feet/yr
1. County Sanitation Districts of Los Angeles County	8	53,728
2. City of Bakersfield	2	24,656
3. City of Modesto	1	14,390
4. City of Fresno	1	13,696
5. Eastern Municipal Water District	5	10,087
6. City of Santa Rosa	2	9,501
7. Irvine Ranch Water District	1	8,740
8. City of Tulare	1	6,248
9. South Tahoe Public Utility District	1	5,085
10. City of Visalia	1	4,861
11. Las Virgenes Municipal Water District	1	4,402
12. Mount Vernon Sanitation District	1	4,247
Total	25	159,641
Percent of Statewide Total	12	60

Freshwater Savings

While reuse in California has always been supported because of the arid and semi-arid conditions in the state, historically its application generally has been motivated as a cost-effective means of wastewater treatment and disposal. Many communities had and still have access near wastewater treatment plants to land suitable for irrigation of crops or pasture. In many cases, agricultural irrigation requires less wastewater treatment than surface water discharge, and in some cases, farmers are willing to pay for the reclaimed water. Thus, agricultural irrigation has been the dominant use of reclaimed water. However, due to drought and long-term water shortages in California, water reclamation and conservation have received significant emphasis in recent years, both in state policy and local water supply planning. Many new projects in the last thirty years have been implemented with water supply benefits primarily in mind.

In this survey the Office of Water Recycling attempted to ascertain whether pollution control or water supply considerations were the primary motivation behind each water reclamation system. Each system was classified as pollution control or water supply according to a judgment based on several factors:

1. Pollution control would be indicated by prohibitions on waste discharge; more stringent requirements for wastewater treatment before discharge than before reuse; low levels of treatment provided; marginal uses of reclaimed water (especially pasture irrigation); reuse occurring on site owned by treatment plant operator; provision of reclaimed water at no charge or, in some cases, payment to users to take the reclaimed water; or lack of freshwater savings.
2. Water supply would be indicated by lack of any unusual treatment or discharge constraints, other facilities being available to dispose of all effluent if reuse did not occur, higher levels of treatment provided for reuse than for alternate disposal, or freshwater savings present.

Survey respondents were asked to indicate for each user of reclaimed water whether it were likely that fresh water would be used if reclaimed water were not available. Thus, it is possible to estimate with reasonable certainty the amount of freshwater savings resulting from the use of reclaimed water. The freshwater savings are reported in Tables 2 and 6 and the classification of systems by motivating factor is summarized in Table 7.

A prohibition against discharge to a surface stream for at least some period of the year was in effect at 133 of the 200 plants. Most of the 133 plants were classified as pollution control systems. However, 18 were classified as water supply because, without wastewater reclamation, evaporation-percolation ponds or ocean disposal were available to dispose of effluent. Other data did not indicate that reclamation was implemented at these 18 plants as the cost-effective means of treatment or disposal of wastewater.

Table 7

**PURPOSE OF WATER RECLAMATION PROJECTS AND RELATED
FRESHWATER SAVINGS (REPLACEMENT)**

Region	Pollution Control		Water Supply		Total Freshwater Savings, acre-feet/yr
	Number of Treatment Plants	Freshwater Savings, acre-feet/yr	Number of Treatment Plants	Freshwater Savings, acre-feet/yr	
1: North Coast	16	11,549	0	0	11,549
2: San Francisco Bay	12	739	6	3,160	3,899
3: Central Coast	13	5,814	2	81	5,895
4: Los Angeles	5	382	15	58,918	59,300
5: Central Valley:					
5F: Fresno	27	65,169	6	9,317	74,486
5R: Redding	4	396	2	171	567
5S: Sacramento	30	25,751	3	159	25,910
6: Lahontan	13	5,499	4	639	6,138
7: Colorado River Basin	4	2,335	3	3,979	6,314
8: Santa Ana	8	10,085	10	16,388	26,473
9: San Diego	8	1,932	9	2,254	4,186
Total	140	129,651	60	95,066	224,717

It is estimated that over 84 percent of reclaimed water use in California in 1987 replaced fresh water. This occurred even though 70 percent (140) of the reclaimed water systems appear to have been constructed as the cost-effective pollution control option. It is important to note that, while reclaimed water use generally replaces fresh water, this replacement does not always lead to an actual augmentation to the state's overall water supply. Wastewater discharged to streams or percolation ponds is available for indirect reuse through downstream diversions or ground water pumping. Planned reuse directly from a wastewater treatment plant may be substituting for an unplanned reuse of the same effluent taking place downstream. An estimated 18 percent of urban wastewater produced statewide was put to unplanned reuse in 1980 [3]. In the northern half of Region 5 unplanned reuse amounted to 89 percent of total wastewater produced.

Wastewater discharged directly or indirectly to saline water bodies is considered lost to the usable water supply; so its recovery for reuse is clearly an augmentation of the state's available water supply. While not quantified, it is known that many of the treatment plants in this survey discharge directly or indirectly to the ocean or other saline water bodies. Most certainly, reclaimed water is making a significant contribution to the state's water supply.

Value of Reclaimed Water

There are a variety of financial arrangements between producers and users of reclaimed water. Some of the factors that come into play are:

1. the role of water reclamation and reuse in meeting requirements for wastewater treatment and disposal, and the resulting allocation of costs to pollution control;

2. the need of the user for a water supply; and
3. the prevailing price of fresh water.

As shown in Table 8, where the needs for pollution control are the driving force for reclamation and reuse, 77 percent of the systems provided the reclaimed water at no cost, or even paid the user to accept the reclaimed water. Systems driven by water supply needs charged for the reclaimed water in 62 percent of the cases, and provided the water at no charge in only 38 percent of the cases. It seems an anomaly to provide reclaimed water for free when the intent of a project is to serve water supply needs. However, there are logical reasons for doing this. For about half of the cases, the reclaimed water is used on a site owned by the agency operating the treatment facilities, including municipal parks or golf courses or excess treatment plant property where beneficial use of both land and wastewater can be obtained through agricultural irrigation. In another case a private golf course apparently obtained reclaimed water at no charge because its developer paid for the wastewater treatment plant, now operated by a public agency.

A summary of the monetary exchanges for reclaimed water is shown in Table 9. Generally, where users are charged for obtaining reclaimed water, the price was less than \$100/acre-foot. With one exception, higher prices all occur in the metropolitan regions, where the competing freshwater supplies are usually imported and treated for potable use. The highest price identified in the survey was \$514/acre-foot for a plant in Marin County. In most of the cases where the unit price could not be determined, the agency operating the wastewater treatment facilities leased both land and reclaimed water to farmers for a single charge.

Table 8
**VALUE OF RECLAIMED WATER BASED ON
 WASTEWATER RECLAMATION SYSTEM PURPOSE AND REGION**

Region	Number of Systems Initiated for Pollution Control			Number of Systems Initiated for Water Supply		
	User Was Charged	User Not Charged	User Was Paid	User Was Charged	User Not Charged	User Was Paid
1: North Coast	2	13	1	0	0	0
2: San Francisco	3	9	0	6	0	0
3: Central Coast	1	11	1	1	1	0
4: Los Angeles	0	5	0	9	6	0
5: Central Valley:						
5F: Fresno	8	19	0	1	5	0
5R: Redding	2	2	0	2	0	0
5S: Sacramento	8	21	1	0	3	0
6: Lahontan	0	13	0	2	2	0
7: Colorado River	2	2	0	1	2	0
8: Santa Ana	5 ^a	3	1 ^a	6	4	0
9: San Diego	3 ^a	5	1 ^a	9	0	0
Total	34	103	5	37	23	0

^a For two plants users were charged for reclaimed water in summer and were paid to accept the reclaimed water in winter.

Table 9
PRICES OF RECLAIMED WATER, 1987

Price Range, \$/acre-foot	Number of Water Reclamation Plants Within Region ^a											
	1	2	3	4	5F	5R	5S	6	7	8	9	Total
<u>User Was Paid</u>												
>0-100	1	0	0	0	0	0	0	0	0	1	1	3
Unit amount unknown	0	0	1	0	0	0	1	0	0	0	0	2
<u>User Not Charged</u>												
	13	9	12	11	24	2	24	15	4	7	5	126
<u>User Was Charged</u>												
>0-100	0	2	2	7	4	3	3	1	1	7	2	32
>100-200	0	2	0	2	0	0	0	0	0	2	2	8
>200-300	0	0	0	1	1	0	0	0	0	2	3	7
>300-400	0	1	0	2	0	0	0	0	0	0	1	4
>400-500	0	0	0	0	0	0	0	0	0	0	2	2
>500-600	0	1	0	0	0	0	0	0	0	0	0	1
Unit amount unknown	2	3	0	1	4	1	5	1	2	1	2	22
Total	16	18	15	24	33	6	33	17	7	20	18	207

^a Some plants are counted more than once because of different prices for customers of given plant. Refer to Figure 2 for the location of the regions.

Treatment Levels

The survey determined the specific treatment processes used at each water reclamation plant, as shown in Appendix B. To provide a general idea of the overall levels of treatment being provided before reuse, four levels of treatment were assigned by the Office of Water Recycling based on the unit processes and on the types of reuse taking place:

1. Secondary, using oxidation pond treatment, including disinfection if provided
2. Other secondary, such as, for example, activated sludge treatment, including disinfection if provided
3. Title 22 tertiary, using filtration and other processes intended to comply with the requirement in the reclamation criteria of the California Department of Health Services, published in Title 22 of the California Code of Regulations [4], for adequately disinfected, oxidized, coagulated, clarified, filtered wastewater, or approved equivalent. Usually secondary effluent is treated by the approved

equivalent of "direct filtration", that is, coagulant addition and mixing directly followed by filtration. The relevant regulations are reproduced in Appendix C.

4. Other tertiary, consisting of any process following secondary treatment, except tertiary intended to comply with wastewater reclamation criteria in Title 22 of California Code of Regulations.

The distinction between the two categories of tertiary treatment was made by interpreting the types of treatment processes indicated and types of reuse taking place. No attempt was made to determine actual permit requirements. All of the wastewater treatment plants surveyed were found to provide at least secondary treatment before reuse. With one exception chlorination is believed to have been the sole method of disinfection before reuse. However, many survey respondents did not specify the type of disinfection, as is reported in Appendix B. The tertiary treatment processes found in the fourth category were filtration, carbon adsorption, denitrification, air stripping, and reverse osmosis. A summary of the levels of treatment provided is shown in Table 10.

The levels of treatment provided for particular uses depend primarily on requirements for health protection. These are specified in Title 22 of the California Code of Regulations excerpted in Appendix C. Other factors include irrigation system constraints, industrial or water quality needs, or requirements for alternate discharge of effluent. A summary of treatment levels provided for specific types of reuse is provided in Table 11.

Table 10
LEVELS OF TREATMENT PROVIDED BY
WASTEWATER TREATMENT PLANTS FOR REUSE

Level of Treatment	Number of Treatment Plants
Primary	0
Secondary - oxidation ponds	51
- other than oxidation ponds	86
Tertiary - "Title 22" (coagulation, clarification, and filtration or approved equivalent)	40
- any processes following secondary treatment except "Title 22" treatment train	23
Total	200

Table 11

LEVELS OF WASTEWATER TREATMENT PROVIDED FOR TYPES OF REUSE

Type of Reuse	Number of Water Reclamation Plants Providing Indicated Treatment				
	Oxidation Ponds	Other Secondary	Title 22 Tertiary	Other Tertiary	Total
Agricultural Irrigation:					
Harvested feed, fiber and seed crops	12	20	1	1	34
Pasture	23	25	4	3	55
Orchards and vineyards	3	4	2	1	10
Tree crops (Christmas trees, firewood, pulp, etc.)	2	1	0	0	3
Nursery and sod crops	0	3	4	1	8
Food crop	0	2	1	0	3
Mixed, other or unknown types of agricultural products	11	19	3	3	36
Landscape Irrigation:					
Schools, playgrounds, parks where Title 22 tertiary effluent required	0	0	7	2	9
Freeway and highway landscape	0	0	8	4	12
Golf courses (including golf course impoundments)	4	13	24	8	49
Mixed, other or unknown types of landscape (including street landscape, slope cover, parks where tertiary effluent not required)	2	6	13	3	24
Landscape Impoundments (excluding golf courses)	0	0	1	0	1
Recreational Impoundment	0	1	3	0	4
Wildlife Habitat Enhancement, Wetlands	1	2	2	0	5
Industrial Reuse:					
Cooling water	0	1	2	2	5
Process water	0	0	1	0	1
Construction, dust control, washdown	1	1	1	1	4
Other or unknown types of industrial reuse	0	1	0	0	1
Ground Water Recharge	0	0	5	0	5
Miscellaneous or unknown types of use or mixed types of above uses	1	4	5	1	11
Total	60	103	87	30	280^a

^a Total exceeds actual number of treatment plants because some plants serve several types of reuse.

In-plant Reuse

The reuse of treated effluent on the site of wastewater treatment plants is probably common practice. However, only 42 plants reported that in-plant use of reclaimed water took place. The data received are not included in the table in Appendix B nor in any of the other summary data included in this report. In-plant reuse has not been fully documented in this report because amounts of in-plant reuse are usually not metered and only a small portion of in-plant reuse appears to have been reported on survey questionnaires. Nevertheless, the data that were collected are of interest.

Of the 42 plants reporting in-plant reuse, 23 reported other deliveries of reclaimed water which are included in other sections of this report. Nineteen plants reported only in-plant reuse. For 30 plants with sufficient data, a median of 0.5 percent and an average of 3.4 percent of total plant flow was reused on the plant site. The range was from 0.04 to 24.3 percent.

Typical in-plant uses cited were landscape irrigation, wash water, chemical feed solution water, spray water to control surface foaming in tanks, pump seal water, and equipment cooling water. The highest percentage of in-plant reuse was reported at a plant where reclaimed water was used in open-ended cooling systems without water recirculation.

III. COMPARISON WITH PREVIOUS SURVEYS

Reclaimed water use increased by 45 percent in California in the decade of 1977-1987, after a period of little increase since 1970. The drought of 1976-1977 appears to have stimulated state and local interest in wastewater reuse. The California State Water Resources Control Board adopted the Policy and Action Plan for Water Reclamation in California in 1977. Soon after, the Office of Water Recycling was created. During the following few years the SWRCB invested in nearly 50 local planning studies for water reclamation. The inability to develop major water supply projects in recent years and continuous population growth have reinforced the interest in and need for local water resources development. In addition, infusion of large amounts of federal and state funds for construction of new and upgraded wastewater treatment facilities provided large volumes of highly treated wastewater. This has resulted in many water reclamation projects to tap the treated wastewater.

Comprehensive statewide and regional surveys of wastewater reclamation and reuse have been published by the California Department of Water Resources and Department of Health Services, covering various years as early as 1953. The years 1970 and 1977 were selected for detailed comparison with the results of the present survey for 1987 [5, 6].

As shown in Table 12, water reuse has increased from 175,220 acre-feet in 1970 to 266,559 acre-feet in 1987. With the exception of industrial use of reclaimed municipal wastewater, all types of reuse have increased in the 17-year period. The distribution amongst the types of reuse has remained relatively consistent, with the exceptions of industrial use and wildlife habitat.

Within the landscape irrigation category there has been a significant increase in the number of golf courses using reclaimed water. There were 39 golf courses reported in the survey for 1977. In 1987 the number increased to 63, which were at least partially irrigated with reclaimed water. This 62 percent increase in the prior decade is at least partially due to the desire to protect the great investment golf courses have in landscaping, which is an essential attraction to golfing. During drought periods, mandatory conservation requirements endanger this investment. Reclaimed water remains available during drought and, thus, provides a secure water supply. Eight additional golf courses are known to have been connected to reclaimed water since 1987, bringing the total served by reclaimed water in 1990 to over 10 percent of the approximately 670 golf courses in California [7, 8].

Two significant declines in reported reuse have occurred since 1970 due to different criteria for reporting. In 1970 one user in the San Diego Region was reported to use 4,290 acre-feet of reclaimed water for golf course irrigation and ground water recharge. The ground water recharge portion was not reported in 1977 or 1987. Based on the information provided for 1987, it appeared that the recharge was due to incidental stream bed percolation after discharge of effluent and, therefore, did not meet the criterion of planned reuse. The 1970 and 1977 surveys did not report reuse within the site of wastewater treatment plants with two exceptions in the Los Angeles Region. To be consistent with the criterion for the 1987 survey to exclude in-plant reuse, this amount, over 6,000 acre-feet, is not reported in the current

Table 12

COMPARISON OF WASTEWATER RECLAMATION SURVEYS BY TYPE OF REUSE

Types of Reuse ^a	Volume of Reclaimed Water					
	1970 ^b		1977 ^c		1987	
	acre-feet/yr	percent of total	acre-feet/yr	percent of total	acre-feet/yr	percent of total
Agricultural irrigation	112,430	64	118,291	64	167,858	63
Landscape irrigation and impoundments	17,690	10	20,326	11	35,231	13
Industrial use	10,320	6	11,886	7	6,034	2
Ground water recharge	29,700	17	26,048	14	38,585	14
Recreational impoundment	4,970	3	6,765	4	6,905	3
Wildlife habitat	0	0	623	<1	9,773	4
Other or mixed types	110	<1	2	<1	2,173	1
Total	175,220	100	183,941	100	266,559	100
Percent increase from prior survey	—		5		45	

^a Amounts for individual plants or users that included more than one type of reuse have been included in this table in the category of assumed predominant use, when appropriate.

^b Derived from Reference 5.

^c Derived from Reference 6.

numbers. Most of this in-plant use was for cooling and maintenance uses and, therefore, appears in the industrial use category for the previous surveys. This omission in the 1987 data accounts for the apparent significant decline in industrial use.

The regional distribution of reuse is shown in Table 13 and Figure 3 for the present and previous two surveys. The significant decline shown for the San Diego Region is due to the omission of the ground water recharge described above.

In addition to comparing the overall amounts as above, changes at each plant were accounted for in the survey. Between 1970 and 1977, 113 wastewater treatment plants were added to the list of plants supplying reclaimed water, while 89 plants were dropped from the list. Between 1977

Table 13

COMPARISON OF WASTEWATER RECLAMATION SURVEYS BY REGION

Region	Number of Water Reclamation Plants and Total Reclaimed Water Use								
	1970 ^a			1977 ^b			1987		
	Number of Plants	Volume of Reuse		Number of Plants	Volume of Reuse		Number of Plants	Volume of Reuse	
		acre-feet/yr	Percent of Total		acre-feet/yr	Percent of Total		acre-feet/yr	Percent of Total
1: North Coast	7	1,090	<1	21	6,688	4	16	13,016	5
2: San Francisco	13	7,070	4	28	10,237	5	18	11,010	4
3: Central Coast	10	9,760	6	14	6,918	4	15	6,141	2
4: Los Angeles	18	29,200	17	19	37,337	20	20	60,257	23
5: Central Valley:									
5F: Fresno	56	66,840	38	46	62,805	34	33	82,997	31
5R: Redding	3	510	<1	6	1,128	1	6	792	<1
5S: Sacramento	21	14,350	8	30	18,789	10	33	32,077	12
6: Lahontan	14	9,060	5	10	8,838	5	17	18,024	7
7: Colorado River Basin	10	6,120	3	6	3,359	2	7	9,076	4
8: Santa Ana	21	16,870	10	23	24,439	13	18	27,280	10
9: San Diego	22	14,350	8	16	3,403	2	17	5,889	2
Total	195	175,220	100	219	183,941	100	200	266,559	100

^a Derived from Reference 5.

^b Derived from Reference 6.

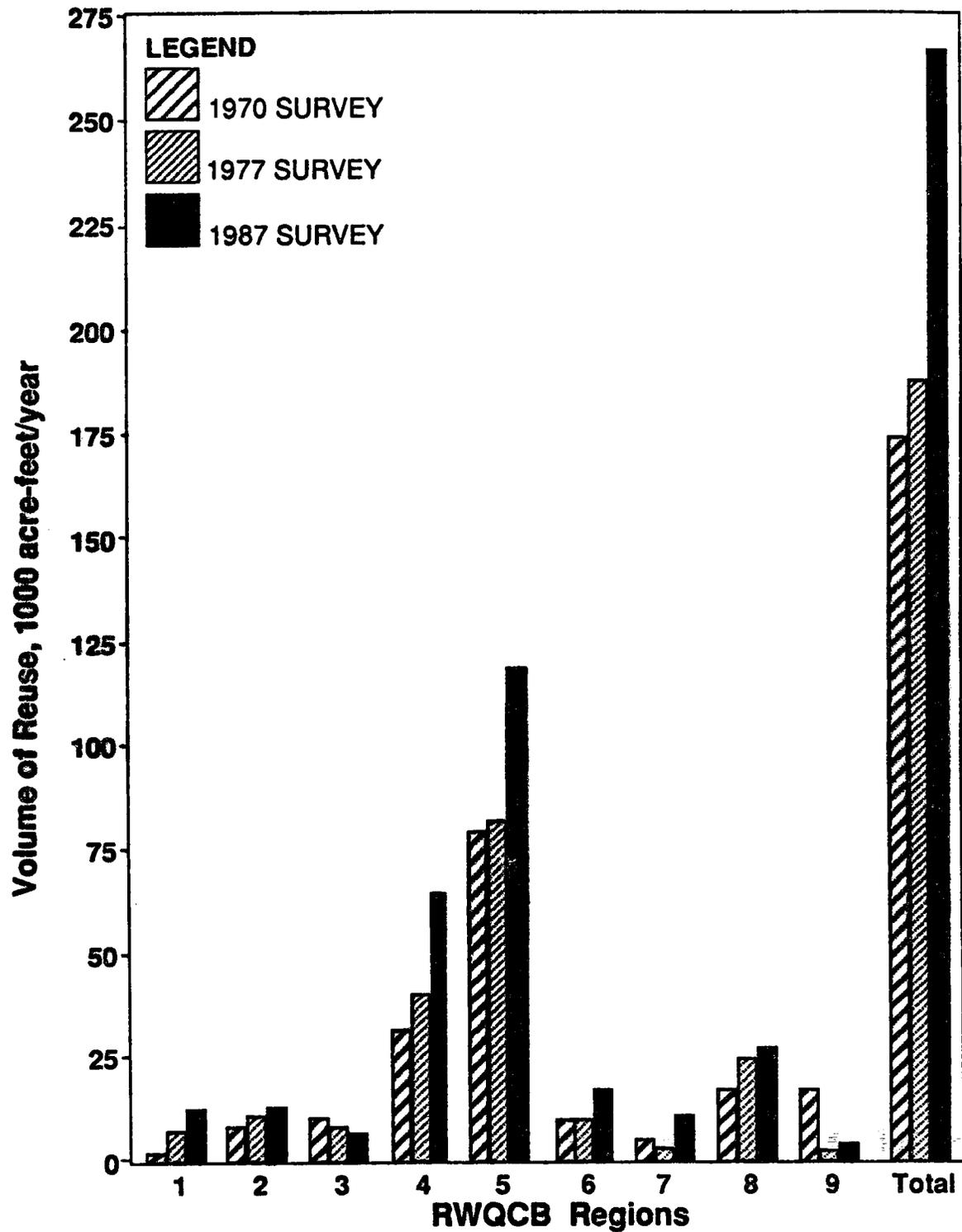


Figure 3. COMPARISON OF WATER RECLAMATION SURVEYS, 1970 - 1987

and 1987, 68 plants were added and 88 were dropped. An attempt was made to document what happened to those plants that did not appear in subsequent listings.

Some of the reasons found or suspected for a wastewater treatment plant not appearing in the current survey are:

1. Reuse was discontinued.
2. Treatment plant was shut down or converted to wet weather plant as part of regional plant construction.
3. Different criteria were used to interpret the reuse reported in prior surveys.
4. Changes in the name of the treatment plant or agency made it difficult to make correlation with a current listing in the survey.
5. Treatment plant was inadvertently omitted in the 1977 or 1987 surveys.

Of the 177 plants dropped by the 1977 and 1987 surveys, there is not sufficient information readily available to confirm the current situation of 91 of the prior listings, some of which may continue to reclaim water.

IV. PROJECTS SINCE 1987

Since 1987 many new water reclamation projects or additions have initiated operation, resulting in a significant increase in reuse. A list of new projects or additions to existing systems that the Office of Water Recycling has information on is shown in Table 14. The list does not include all increases since 1987. The current added deliveries or design capacities amount to approximately 48,460 acre-feet/year, an 18 percent increase over 1987.

Along with four projects already operating in 1987, nine of the projects in Table 14 received grant or loan assistance from the SWRCB. A total of \$26.7 million has been provided by the SWRCB for design and construction of these 13 currently operating water reclamation projects implemented for the purpose of water supply benefits. The total deliveries from these projects upon full implementation will be 20,163 acre-feet/year. Many others have received SWRCB and federal assistance for water reclamation projects as part of wastewater treatment and disposal improvements. The Metropolitan Water District of Southern California has also provided significant financial assistance through its Local Projects Program.

Table 14

WASTEWATER RECLAMATION PROJECTS OR ADDITIONS STARTED AFTER 1987

Agency	Approximate New Reclaimed Water Deliveries or Design Capacity, acre-feet/yr	Start of Operation	Type of Reuse
City of Cerritos	1,500	Spring 1988	Landscape irrigation
Coachella Valley Water District	670	Fall 1988	Nursery irrigation
Desert Water Agency	870	Fall 1988	Golf course irrigation
East Bay Dischargers Authority	22,400	Spring 1988	Freshwater marsh
East Bay Municipal Utility District	330	Summer 1989	Golf course irrigation
Eastern Municipal Water District	4,500	Fall 1989	Wildlife habitat, fodder crops
Irvine Ranch Water District	2,440	Summer 1989	Landscape irrigation
City of Lakewood	440	Fall 1989	Landscape irrigation
Long Beach Water Department	1,200	Summer 1989	Landscape irrigation
Los Angeles County Sanitation District	7,300	Summer 1989	Ground water recharge
City of Petaluma	550	Fall 1989	Golf course irrigation
City of Santa Barbara	710	Summer 1989	Landscape, golf course irrigation
City of Santa Clara	440	Summer 1989	Golf course irrigation
Santa Margarita Water District	2,560	Winter 1988	Landscape irrigation
City of Santa Rosa	550	Spring 1989	Golf course irrigation
Trabuco Canyon Water District	500	Summer 1989	Landscape, golf course irrigation
Triunfo County Sanitation District	1,500	Winter 1989	Landscape, golf course irrigation
Total	48,460		

V. SURVEY PROCEDURE AND DATA BASE

This comprehensive survey took place over a period beginning about mid 1988 through the end of 1989. It consisted of the following steps:

1. Identification of wastewater treatment plants to survey
2. Design of questionnaire
3. Sending questionnaire and receiving completed questionnaires
4. Clarification of data in questionnaires through telephone contacts
5. Entry into and verification of data in computer.

The survey was initially intended to gather information on the beneficial reuse of all treated municipal or industrial wastewater. The scope was later narrowed to include only treated municipal wastewater. The sources of names of potential wastewater treatment plants to survey included:

1. State Waste Discharge System data base of the State Water Resources Control Board
2. Water reclamation plants identified in surveys by the Department of Health Services for the years 1977 and 1983
3. Information provided by the Regional Water Quality Control Boards, the Department of Water Resources, and individuals from other agencies.

The questionnaire was designed to obtain data consistent with the objectives of the survey and to be relatively short. A copy of the questionnaire is in Appendix A. About 750 questionnaires were mailed in mid 1988 in two mailings. Additional questionnaires were mailed in 1988 and 1989 when additional possible qualifying treatment plants were identified. A second mailing was made in September 1988 to those failing to respond to one of the first mailings. Recipients of the questionnaire included those involved in the reuse of treated municipal or industrial wastewater.

After assessing the amount of effort required to complete a comprehensive survey including the reuse of industrial wastewater, it was decided to confine this survey report to the reuse of domestic or municipal wastewater. Thus, effort was concentrated on ensuring responses from domestic or municipal wastewater treatment plants. Questionnaires from these plants were thoroughly reviewed and telephone calls were made to most of these respondents to clarify all responses.

A computer data base using the R:Base program was designed to include all data on questionnaires. Data have been entered into computers for the wastewater treatment plants listed in Appendix B as well as for a number of other plants that used to provide or plan on providing reclaimed water and some facilities involved in reuse of industrial wastewater.

Despite a determined effort to include all uses of reclaimed domestic and municipal wastewater in California in 1987, a few facilities were likely not identified and did not receive a questionnaire. In addition, the questionnaires from some respondents could not reliably be interpreted for inclusion in this report, and some agencies did not respond after repeated reminders. Based on a correlation of this survey with previous surveys, the sketchy information available on some facilities, and the effort made to account fully for all reuse in 1987, facilities missing from data in this report are believed to be generally small, amounting to less than a total of 2,000 acre-feet/year and 10 wastewater treatment plants.

There were unexpected difficulties in conducting this survey, especially because a high degree of accuracy and a near total response were essential for credible reporting. Considerable time was spent contacting agencies to obtain a response, reviewing questionnaires, and further contacting respondents to clarify data. Establishing a new computerized data base and accurately entering the data were also an unexpected challenge. Most respondents, however, were very cooperative, and the result is a body of data that can easily be retrieved with high selectivity. The Office of Water Recycling is thankful to those who participated in this comprehensive survey.

Future surveys will be easier to undertake because of the experience gained and improvements in the questionnaire and survey procedures. Readers are encouraged to notify the Office of Water Recycling of corrections in the data presented and suggest changes for future surveys.

The summary table in Appendix B does not include all data collected for the listed facilities, nor any of the data for facilities not the subject of this report. Other types of data collected can be seen by referring to the questionnaire shown in Appendix A. These data are available by arrangement with the Office of Water Recycling.

VI. REFERENCES

1. California Water: Looking to the Future, Bulletin 160-87, California Department of Water Resources, Sacramento, California, November 1987.
2. Inventory of Waste Water Production and Waste Water Reclamation Practices in California, 1972, Bulletin No. 68-72, California Department of Water Resources, Sacramento, California, October 1973.
3. The California Water Plan: Projected Use and Available Water Supplies to 2010, Bulletin No. 160-83, California Department of Water Resources, Sacramento, California, December 1983.
4. Title 22, California Code of Regulations, Sections 60301 et seq., published in "Wastewater Reclamation Criteria", California Department of Health Services, Sanitary Engineering Section, Berkeley, California, 1978.
5. Inventory of Waste Water Production and Waste Water Reclamation Practices in California, 1970-1971, Bulletin No. 68-71, California Department of Water Resources, Sacramento, California, November 1972.
6. Catherine S. Ling, Wastewater Reclamation Facilities, Survey Report, 1978, California Department of Health Services, Sanitary Engineering Section.
7. Automobile Club of Southern California and California State Automobile Association, Southern California Golf Courses, Automobile Club of Southern California, Los Angeles, California, 1989.
8. Automobile Club of South California and California State Automobile Association, Northern California and Nevada Golf Courses, Automobile Club of Southern California, Los Angeles, California, 1988.

Appendix A
SURVEY QUESTIONNAIRE

OFFICE OF WATER RECYCLING
CALIFORNIA STATE WATER RESOURCES CONTROL BOARD
P.O. Box 944212
Sacramento, CA 94244-2120

MUNICIPAL WASTEWATER RECLAMATION FACILITY QUESTIONNAIRE

INSTRUCTIONS FOR COMPLETING QUESTIONNAIRE

The purpose of this questionnaire is to collect information related to the types and quantities of use of reclaimed water in California and to the types of wastewater treatment provided for reclamation. The use of reclaimed water makes a significant contribution to the water supply of California. However, accurate data on wastewater reclamation facilities are not available because a detailed survey has not been done since 1978.

1. Please complete one questionnaire for each of your water reclamation facilities.

2. Please return questionnaire by August 1 1988 to:

Richard Wasser
Office of Water Recycling
State Water Resources Control Board
P.O. Box 944212
Sacramento, CA 94244-2120

3. If another agency has the lead responsibility for managing the treatment, distribution, or sale of the reclaimed water and would be more capable of completing all or portions of the questionnaire, please complete as much as you can and forward the questionnaire to the other agency to complete remaining portions.

4. All information is to be based on 1987 calendar year.

5. Please include in the questionnaire all uses of reclaimed water, where the reclaimed water:

- a. Replaces a fresh water use.
- b. Augments a fresh water supply (for example: ground water recharge).
- c. Results in a useful product (for example: pasture, harvested crops, or recreational use of stream or lake that would not occur with natural water flows). For example, land disposal of effluent is considered a reclaimed water use if the land is used for grazing or growing a crop, even though this might not replace fresh water.

6. We are trying to distinguish whether the use of reclaimed water replaces fresh water or is primarily for disposal. Thus in part B of the questionnaire we ask for your opinion on whether fresh water would probably be used if reclaimed water were not available.

7. The following abbreviations are used in this questionnaire:

ADF: Average Dry Weather Flow
MGD: Million Gallons per Day
MG/yr: Million Gallons per Year
\$/acre-ft: Dollars per Acre Foot

8. Thank you for cooperating with this survey. Any questions on this questionnaire can be directed to Richard Wasser at (916)739-4268.

MUNICIPAL WASTEWATER RECLAMATION FACILITY QUESTIONNAIRE

A. RECLAIMED WATER PRODUCTION

1. Name and address of reclamation plant:

2. County: _____

3. Name and address of agency operating facility (if different from A.1):

4. Name and address of agency completing questionnaire (if different from A.3):

5. Name and title of person completing questionnaire:

Telephone () _____

6. Treatment Process (attach flow schematic if available):

<input type="checkbox"/> Primary sedimentation	<input type="checkbox"/> Coagulation/Flocculation
<input type="checkbox"/> Trickling filter	<input type="checkbox"/> Filtration
<input type="checkbox"/> Activated sludge	<input type="checkbox"/> Other (explain): _____
<input type="checkbox"/> Oxidation pond	
<input type="checkbox"/> Disinfection	

7. Effluent disposal or reuse options available:

- Discharge to fresh water
- Discharge to marine/brackish water
- Evaporation/percolation pond (effluent disposal, and not groundwater recharge, is primary purpose)
- Planned groundwater recharge
- Slow rate land disposal (for example: irrigation or overland flow where effluent disposal is the primary purpose)
- Other reuse (explain): _____
- Other (explain): _____

8. Is discharge to surface water prohibited during parts or all of the year?
Yes No

If discharge is allowed all or part of the year, what general requirements on treatment or periods of discharge are there?

- Secondary treatment
- Nitrogen removal
- Other (list): _____

9. 1987 Average Dry Weather Flow (ADWF): _____ MGD

10. Design Capacity of Treatment Plant (ADWF): _____ MGD

11. Amount of flow reused in 1987 (including groundwater recharge and productive land disposal):

_____ Million Gallons per Year

12. Additional remarks: _____

B. RECLAIMED WATER USE

1. Did another agency have lead responsibility for the distribution or sale of the reclaimed water in 1987? Yes ___ No ___ If yes,

agency name and address: _____

Telephone No. (____) _____

2. List Reclaimed Water Users in 1987 (for example: individual farmer, city, private golf course, etc.):

a. Name of use area and address (approximate address is acceptable):

Type of use (for example: in-plant use, landscape irrigation, cooling water, strawberry irrigation, cotton irrigation, recreation lake, etc.):

Quantity: _____ MG/yr

Entity managing use area: _____

Phone No. (if known): (____) _____

Would fresh water probably be used if reclaimed water were not available?
Yes ___ No ___

If more than one reclaimed water user please fill out as many boxes as needed. Duplicate page 4 if more sheets are needed.

b. Name of use area and address (approximate address is acceptable):

Type of use (for example: in-plant use, landscape irrigation, cooling water, strawberry irrigation, cotton irrigation, recreation lake, etc.):

Quantity: _____ MG/yr

Entity managing use area: _____

Phone No. (if known): (____) _____

Would fresh water probably be used if reclaimed water were not available?
Yes ___ No ___

c. Name of use area and address (approximate address is acceptable):

Type of use (for example: in-plant use, landscape irrigation, cooling water, strawberry irrigation, cotton irrigation, recreation lake, etc.):

Quantity: _____ MG/yr

Entity managing use area: _____

Phone No. (if known): (____) _____

Would fresh water probably be used if reclaimed water were not available?
Yes ___ No ___

d. Name of use area and address (approximate address is acceptable):

Type of use (for example: in-plant use, landscape irrigation, cooling water, strawberry irrigation, cotton irrigation, recreation lake, etc.):

Quantity: _____ MG/yr

Entity managing use area: _____

Phone No. (if known): (____) _____

Would fresh water probably be used if reclaimed water were not available?
Yes ___ No ___

e. Name of use area and address (approximate address is acceptable):

Type of use (for example: in-plant use, landscape irrigation, cooling water, strawberry irrigation, cotton irrigation, recreation lake, etc.):

Quantity: _____ MG/yr

Entity managing use area: _____

Phone No. (if known): (____) _____

Would fresh water probably be used if reclaimed water were not available?
Yes ___ No ___

California State Water Resources Control Board
Office of Water Recycling
MUNICIPAL WASTEWATER RECLAMATION SURVEY
1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
ALAMEDA							
Livermore WRP, City of	PS AS F CH	6.25	5	Las Positas Golf Course Livermore Municipal Airport Caltrans	Golf course irrigation Landscape irrigation, fire protection Freeway irrigation	332 34 2	105
Oro Loma/Castro Valley WTP (East Bay Discharge Auth. facilities only)	*D	0.80	0.14	Skywest Golf Course	Golf course irrigation	160	188
ALPINE							
No reclamation identified							
AMADOR							
Camanche North Shore WTP	OP	0.03	0.03	Camanche North Shore fields	Pasture irrigation	34	0
Mule Creek State Prison WTP	AS D	0.74	0.57	Mule Creek State Prison	Pasture irrigation	35	0
Plymouth STP, City of	OP D	0.25	0.16	Roy Mason	Pasture irrigation	174	0
Sutter Creek TP (Amador Reg. Sanitation Authority)	TF D	0.30	0.28	Farmer/Cattle Rancher CYA, Preston School of Industry Various ranchers	Pasture irrigation Toilet flushing, lawn watering, fire protection (filtration, chlorination provided before use) Pasture irrigation & stockwater	181 120 15	14

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
BUTTE							
Sewerage Commission-Oroville Region WTP	PS AS F D	6.50	2.9	Pacific Oroville Power Inc.	Cooling tower water	61	27
Springs of Living Water STP	PS OP CH	0.03	0.02	Springs of Living Water	Grass irrigation	9	0
CALAVERAS							
Angels WTP, City of	AS D	0.31	0.20	City of Angels/Roller Family	Pasture irrigation	271	*
Copper Cove STP (Calaveras CWD)	OP CH	Unk	Unk	Farmer	Pasture irrigation	58	0
La Contenta TP (Calaveras CWD)	OP F CH	Unk	Unk	La Contenta Golf Club	Golf course irrigation	27	0
Murphy SD WTP	OP	0.21	0.13	Kramer Ranch	Pasture, apple orchard irrigation	88	0
COLUSA							
No reclamation identified							
CONTRA COSTA							
Mt. View SD WTP	PS TF CH	1.71	1.54	Mt. View SD Wetlands Reclamation Project	Wetlands enhancement	1,768	0
Oakley Bethel Island WRF	OP	1.50	1.2	District property Emerson Dairy	Pasture irrigation Leaching of soil salinity	1,074 270	*
West Contra Costa SD WTP (East Bay MUD)	PS AS D	12.50	6.5	Richmond Country Club	Golf course irrigation	153	80

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey - 1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
DEL NORTE							
Best Western Ship Ashore Motel STP	OP CH	0.07	0.03	Property owned by motel	Pasture irrigation	34	0
EL DORADO							
El Dorado Hills WRP (El Dorado Irr Dist)	PS TF OP CH	1.20	0.6	Wetsel-Oviatt Lumber Co. El Dorado Hills Golf Course	Log deck watering Golf course irrigation	218 86	23
South Tahoe PUD STP	PS AS C F CH CA	7.50	4.25	Indian Creek Reservoir	Recreation use	5,085	0
FRESNO							
Coalinga WTP, City of	PS OP	0.91	0.85	Coalinga School Farm	Alfalfa, cotton, pasture irrigation	399	27
Fresno-Clovis Metropolitan Area Regional Wastewater Facilities	PS TF AS	60.00	46.26	Fresno Irrigation District Al Coelho Cal-Growers Vineyard Joe Souza CRS Farming, Fresno Alvin Quist	Misc. crop irrigation Grapes, barley irrigation Grapes irrigation Alfalfa, barley irrigation Vineyard irrigation Cotton irrigation	5,831 1,897 1,599 1,584 1,516 1,271	0
Mendota WTP, City of	OP	0.57	0.92	Floyd Williams	Alfalfa irrigation	522	0
Orange Cove WTP, City of	PS TF AS OP	0.75	0.55	Tagus Ranch	Orange grove irrigation	133	0
Parlier WTP, City of	OP	1.10	0.45	City of Parlier Farmer	Vineyard irrigation Tree, vine irrigation	307 31	*
Selma-Kingsburg-Fowler CSD WTP	AS F D	8.00	2.36	Selma-Kingsburg-Fowler CSD Galen E. Bonjour	Cotton and wheat irrigation Plum orchard irrigation	182 142	0

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
GLENN							
No reclamation identified							
HUMBOLDT							
Arcata WTP, City of	PS OP CH W	2.30	1.8	Arcata Marsh & Wildlife Sanctuary	Freshwater marsh enhancement	1,669	0
Ferndale WTP, City of	OP	1.50	0.23	Elias P. Sousa	Pasture irrigation	97	0
IMPERIAL							
Calipatria WTP, City of	OP	0.50	0.47	Huffman and Allen Farms	Crop irrigation	172	0
INYO							
Bishop WTF, City of	PS OP	1.60	0.71	Farmer	Pasture irrigation	398	*
Eastern Sierra Comm Serv Dist STP	PS OP	0.85	0.67	Jim Tatum	Pasture irrigation	574	0
Furnace Creek Inn/Ranch STP	AS	0.20	0.16	Furnace Creek Golf Club	Golf course irrigation	84	0
KERN							
Arvin CSD WTP	AS	0.80	0.72	Duncan Farms	Alfalfa, cotton irrigation	807	0
Bakersfield WTP #2, City of	PS OP	19.00	15.03	Gary Garone Farms	Cotton, barley, wheat, alfalfa irrigation	16,830	*
Bakersfield WTP #3, City of	PS TF	8.00	6.99	Tenneco West Inc. Busch Industrial Products Corp.	Orchard, vineyard, fodder, fiber and seed crop irrigation Alfalfa, wheat irrigation	7,212 614	0

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey - 1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
Bear Valley Comm Serv Dist STP	AS F D	0.10	0.05	Bear Valley Golf Course	Golf course irrigation	33	218
Delano WTP, City of	PS TF	3.60	2.72	Delano WTP, Molica Farms	Cotton, grain irrigation	3,052	0
Kern County Sheriff's Lerdo Facility STP	OP	0.50	0.26	Kern Cnty Sheriff's Lerdo Facility	Pasture, fodder irrigation	336	0
Lamont PUD WTP	PS OP	1.20	1	Kaiser Bros.	Pasture irrigation	1,105	0
McFarland STP, City of	OP	0.5	0.5	Farmer	Cotton, alfalfa irrigation	560	0
Mount Vernon San Dist (Kern Cnty Public Works)	PS TF	6.60	3.8	Farmer	Cotton, wheat, corn irrigation	4,247	*
North of River SD WTP	PS TF	4.00	3.2	Gene Johnson	Cotton, alfalfa irrigation	3,584	0
Ridgecrest (City of), China Lake Naval Weapon Center WTF	PS OP CH	4.40	3.9	China Lake Golf Course	Golf course irrigation	595	0
Stallion Springs Comm Serv Dist WTP	AS	0.50	0.02	Horse Thief Golf & Country Club	Golf course irrigation (rough areas)	18	0
Taft Heights/Ford City SD Joint WTF (City of Taft)	OP D	1.20	0.80	Creekside Farms	Alfalfa irrigation	430	0
Wasco PUD WTP	PS TF OP	1.95	1.40	Crettol Farms	Cotton, sugar beets, alfalfa irrigation	1,488	*
KINGS							
Hanford WTP, City of	PS TF D	6.00	3.6	Sanchez Bros. Farming	Cotton, alfalfa, row crop irrigation	3,793	3
Lemoore WTP, City of	OP	2.00	2	West Lake Farms	Non-edible crop irrigation	2,240	2

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
LAKE							
Lakeport WTP, City of	PS TF D	0.57	0.5	B. Jones	Pasture irrigation	562	*
Northwest Regional WTF (Lake Cnty San Dist)	AS D	2.10	1.63	Gerald Beeson	Pasture irrigation	1,826	*
Southeast TP (Lake Cnty San Dist)	AS CH	1.49	0.80	Russ Rustici	Pasture irrigation	989	*
LASSEN							
California Correctional Center Susanville STP	OP	0.68	0.5	California Correctional Center	Alfalfa irrigation	276	0
LOS ANGELES							
Burbank WRP, City of	PS AS F D	9.00	15	Public Service Department	Powerplant cooling water	552	60
Donald C. Tillman WRP (City of Los Angeles)	PS AS C F CH DC	40.00	35	Japanese Garden Lake	Recreational lake and landscaping	2,802	0
La Canada WRP (CSD of Los Angeles Cnty)	PS AS D	0.20	0.1	La Canada-Flintridge Country Club	Golf course irrigation and impoundments	123	0
Lancaster WRP (CSD of Los Angeles Cnty)	PS OP C F CH	6.50	6.3	Piute Pond Merco Construction Engineers Apollo Lakes County Park	Wildlife refuge enhancement Soil compaction and dust control Recreational lake & landscape irrigation	5,156 184 146	0
Long Beach WRP (CSD of Los Angeles County, Long Beach Water Dept)	PS AS C F D	25.00	19.68	15 landscape users (continued on next page)	Parks, schools, athletic fields and general landscaping	1,600	100

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
				Skylinks Golf Course	Golf course irrigation	261	
				El Dorado Park Golf Course	Golf course irrigation	246	
				Recreation Park Municipal Golf Course	Golf course irrigation	215	
				Heartwell Golf Course	Golf course irrigation	101	
				Recreation 9-Hole Golf Course	Golf course irrigation	92	
				2 freeway use locations	Freeway irrigation	61	
				2 nursery users	Nursery stock irrigation	31	
Los Angeles-Glendale WRP (City of Los Angeles)	PS AS C F CH DC	20.00	20.00	Harding Municipal Golf Course	Golf course irrigation	399	191
				Wilson Municipal Golf Course	Golf course irrigation	184	
				Griffith Park	Landscape irrigation	145	
				Caltrans	Freeway irrigation	5	
Los Coyotes WRP (CSD of Los Angeles County, Cities of Cerritos and Bellflower)	PS AS C F D	37.50	36.58	Cerritos Iron-Wood Nine	Golf course irrigation	92	15
				Ruth B. Caruthers Park	Landscape irrigation	28	
Palmdale WRP (CSD of Los Angeles County)	PS OP	3.10	4.7	Merco Construction Engineers	Soil compaction & dust control	34	20
				Hartland Tree Farm	Eucalyptus tree irrigation	17	
				East Grove Avenue	Pistachio irrigation	6	
				Biomass Research Project	Tree irrigation	6	
Phosphate Removal Plant (City of Glendale)	* C F	11.80	0.26	Grayson Power Plant	Cooling tower water	352	0
Pomona WRP (CSD of Los Angeles County, City of Pomona, Walnut Valley Water District)	PS AS C F D	10.00	9.56	Garden State Paper Company	Paper manufacturing	3,563	22-314
				San Gabriel River	Groundwater recharge	1,820	
				30 landscape users	Parks, schools, athletic fields and general landscape irrigation	1,752	
				Calif. Poly. Univ. Pomona	Misc. landscape and agricultural irrigation	1,203	
				Simpson Paper Company	Paper manufacturing	835	

Note: Refer to end of table for notes.

(continued on next page)

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
				Diamond Bar Golf Course	Golf course irrigation	322	
				3 freeway use locations	Freeway irrigation	84	
				Lanterman State Hospital	Misc. agricultural irrigation	18	
Probation Camps, Afflerbaugh-Paige STP (Cnty of LA)	AS OP D	0.05	0.02	Marshall Cyn. Tree Farm	Tree irrigation	20	0
Probation Camps, Miller-Kilpatrick STP (Cnty of LA)	AS OP D	0.05	0.03	Probation Camp	Landscape irrigation	15	0
Pt. Dume Club WRP	AS C F CH	0.07	0.06	Pt. Dume Club Mobile Home Park	Landscape irrigation	46	0
San Jose Creek WRP (CSD of Los Angeles County, City of Industry)	PS AS C F D	62.50	59.36	Rio Hondo Spreading Grounds	Ground water recharge	12,392	9-49
				San Gabriel Spreading Grounds	Ground water recharge	5,852	
				Industry Hills Golf Club	Golf course irrigation & impoundments	598	
				Industry Hills Recreation and Conservation Area	Landscape irrigation for slope protection & impoundment	583	
				California Country Club	Golf course irrigation	368	
				Norman's Nursery	Nursery stock irrigation	54	
				Arbor Nursery	Nursery stock irrigation	8	
Tapia WRP (Las Virgenes MWD)	PS AS C F D	8.00	6.4	113 landscape areas	Misc. landscape irrigation	2,101	176-365
				10 landscape users	Parks, schools, & university irrigation	571	
				Rancho Las Virgenes-Tapia WRF	Misc. agricultural irrigation	497	
				Calabasa Landfill	Irrigation, dust control, compaction	368	
				Calabasas Golf and Country Club	Golf course irrigation	331	
				Malibu Valley Farms	Horse pasture irrigation	153	
				Central Valley Calabasas	Landscape irrigation & construction	123	
				Lake Lindero Golf Course	Golf course irrigation	92	
				2 Users	Fire break & suppression irrigation	92	
				Woodland Construction	Landscape irrigation & construction	61	
Caltrans	Freeway irrigation	12					

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
Top O Topanga Mobile Home Estates STP	AS CH	0.04	0.02	Top O Topanga Mobile Home Estates	Landscape irrigation	25	0
Whittier Narrows WRP (CSD of Los Angeles County)	PS AS C F D	15.00	14.17	Rio Hondo Spreading Grounds San Gabriel Spreading Grounds	Groundwater recharge Groundwater recharge	11,143 4,732	7
MADERA							
Chowchilla WTP, City of	AS	1.80	1.18	Pete Cornaggia	Cotton irrigation	43	0
Madera WTP, City of	PS TF OP	7.00	3.76	Jim Armentrout	Cotton irrigation	4,228	0
Wildwood Mobile Home Park STP	AS	0.02	0.01	Wildwood Mobile Home Park	Pasture irrigation	11	0
MARIN							
Ignacio TP (Novato SD)	PS TF F D	2.00	1.61	Novato SD Reclamation Project	Pasture irrigation	767	0
Las Gallinas Valley SD WTP	PS TF F CH	2.90	2.6	Rancher	Pasture irrigation	377	*
Las Gallinas Valley SD WTP (Marin MWD facilities only)	* F CH	1.00	0.05	McInnis Park Manuel T. Freitas Parkway Smith Ranch Road Park 'n Ride	Landscape irrigation Freeway irrigation Freeway irrigation	34 7 2	310
Novato TP (Novato SD)	PS AS F D	4.50	3.12	Novato SD Reclamation Project	Pasture irrigation	1,455	0
Tomaes WTP (North Marin WD)	OP F	0.04	0.02	A. Lodi	Pasture irrigation	20	20
Treatle Glen TP (Richardson Bay SD)	* TF OP D	0.12	0.05	McKegney Greens	Landscape irrigation	24	514

Note: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
MARIPOSA							
No reclamation identified							
MENDOCINO							
Westport CWD TP	OP CH	0.02	0.01	Westport County Water District	Pasture irrigation	12	0
Willits WQCP, City of	AS D	1.30	0.86	City disposal site Hoguenstadt Ranch	Pasture, hay irrigation Grazing land	276 71	0
MERCED							
Los Banos WTP, City of	OP	2.50	2	City of Los Banos WTP	Pasture irrigation	278	0
Merced WTF, City of	PS AS D	10.00	7.29	Wetland/wildlife area	Wetland/wildlife enhancement	1,008	0
MODOC							
No reclamation identified							
MONO							
Mammoth CWD STP	PS AS F D	2.20	1.5	Various contractors Town of Mammoth Lakes	Dust control and compaction Landscape irrigation	8 2	0
MONTEREY							
Carmel Valley CSD	RB C F D	0.10	0.04	Carmel Valley Ranch and Golf Course	Golf course irrigation	39	0

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
NAPA							
Dunaweal WTP (City of Calistoga)	PS OP C F CH	0.80	0.62	Mt. St. Helena Golf Course and Napa Cnty Fairgrounds	Golf course irrigation	178	0
				Maxfield Property	Horse pasture	64	
				Fox Property	Horse pasture	60	
				Calistoga High School, Little League Field	Landscape irrigation	18	
				Calistoga Soaring Center	Landscape irrigation	6	
Meadowood Resort Hotel STP	AS F CH	Unk	Unk	Meadowood Resort Hotel	Golf course irrigation	22	0
Pacific Union College STP	PS TF AS OP	0.20	0.19	Pacific Union College	Fodder irrigation	214	0
Suscol WTF (Napa SD)	PS OP D	15.40	7	Chamberlain Farms	Feed crop irrigation	792	0
				Kirkland Cattle Company	Pasture irrigation	211	
				Napa County Airport	Alfalfa irrigation	122	
Yountville/CA Veterans Home Joint WTF	PS TF C F D	2.00	0.43	Chimney Rock Golf Course	Golf course irrigation	153	0
				Veterans Home	Hay field	104	
NEVADA							
Lake of the Pines WTP (Nevada CSD No. 1)	OP C F CH DC	0.41	0.29	Lake of the Pines WTP	Pasture irrigation	169	0
ORANGE							
Aliso Water Management Agency Coastal STP (South Coast WD facilities only)	* C F CH	2.61	0.88	The Links at Monarch Beach Niguel Shores Community Assoc. Aliso Creek Golf Course (continued on next page)	Golf course irrigation Landscape irrigation Golf course irrigation	279 132 59	348

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
				Stein-Brief Development	Landscape irrigation	37	
				The Tennis Club Villas	Landscape irrigation	31	
				Sea Canyon Park	Landscape irrigation	26	
				Dana Hills High School	Landscape irrigation	26	
				Emerald Ridge Homeowners Assn	Landscape irrigation	16	
				Antigua at Monarch Beach	Landscape irrigation	16	
				Aliso Beach Park	Landscape irrigation	5	
AWMA/MNWD Joint Regional Plant (Moulton Niguel WD)	PS AS C F D	12.00	6.0	El Niguel Country Club	Golf course irrigation	220	279
El Toro WD WTP	PS AS D	6.00	4.4	Laguna Hills Golf Club	Golf course irrigation	314	
				Sea Tree Nursery	Tree irrigation	85	
Los Alisos WD STP	OP C F D	5.50	3.19	V.P. Baker, et al	Citrus irrigation	776	100
				65 landscape users	Landscape irrigation	602	
Michelson WRP (Irvine Ranch WD)	PS AS C F D	15.00	7	145 landscape users	Landscape irrigation	4,471	200
				2 farmers	Crop irrigation	2,528	
				San Joaquin Duck Club	Duck ponds	601	
				El Toro Marine Memorial Golf Course	Golf course irrigation	540	
				Rancho San Joaquin Golf Course	Golf course irrigation	371	
				Caltrans	Freeway irrigation	229	
Oso Creek WRP (Santa Margarita WD)	AS TF C F D	2.00	0.62	81 landscape users	Parks, school, greenbelts, and slope protection landscape irrigation	393	492
				Casta del Sol Golf Course	Golf course irrigation	125	
				Caltrans	Freeway irrigation	120	
				Herrmana/Jensen Nursery	Nursery stock irrigation	53	
San Clemente WRP, City of	PS AS C F D	4.00	3.7	San Clemente Municipal Golf Course	Golf course irrigation	283	141

Note: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
Water Factory 21 (Orange Cnty WD)	* C F CA RO	13.00	2.72	Orange County Water District	Seawater intrusion barrier, ground water recharge	2,627	*
PLACER							
Lincoln WRP, City of	OP CH	0.80	0.6	Charles Joiner	Construction dust control, pasture irrigation	338	0
Placer Cnty Serv Area #6 - Sheridan (Cnty Public Works)	OP	0.04	0.04	Bud Morrison	Pasture irrigation	34	0
PLUMAS							
Quincy Comm Serv Dist WTP	RB OP CH DC	2.20	0.75	Gene Drybread	Fodder crop and pasture irrigation	359	2
RIVERSIDE							
Corona WTP, City of	PS AS D	5.50	6.13	Farmer	Alfalfa irrigation	307	0
Hemet/San Jacinto Reg. WRF (Eastern MWD)	PS AS D	7.50	7.3	Record Farms	Alfalfa irrigation	1,231	16
				Westra Ranch	Duck ponds & alfalfa irrigation	850	
				Buena Vida Farms	Duck ponds & alfalfa irrigation	841	
				C&R Farms	Alfalfa irrigation	638	
				Matson Dairy	Alfalfa irrigation	374	
				Eberly Ranch	Alfalfa irrigation	298	
				Alta Nursery	Nursery plant irrigation	98	
				Taber Duck Club	Duck ponds	98	
Indian Hills WRP (Jurupa Community Serv Dist)	AS C F D	0.80	0.64	Indian Hills Golf Course	Golf course irrigation	540	0
				Santa Ana River Lakes	Groundwater recharge	18	
				Villa De Anza Retirement Hotel	Landscape irrigation, pond	6	

Note: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
March Air Force Base STP	PS TF OP D	1.20	0.45	General Old Golf Course VA National Cemetery	Golf course irrigation Landscape irrigation	313 190	0
Palm Desert Country Club WRP #9 (Coachella Valley WD)	AS D	0.45	0.4	Palm Desert Country Club	Golf course irrigation	384	*
Palm Desert WRP #10 (Coachella Valley WD)	AS C F D	10.00	6.02	Palm Desert Greens Santa Rosa Country Club Portola Country Club	Golf course & greenbelt irrigation Golf course & greenbelt irrigation Golf course & greenbelt irrigation	346 324 144	33
Palm Springs STP, City of	PS TF F D	10.90	7.1	Palm Springs Municipal Golf Course Demuth Park	Golf course irrigation Landscape irrigation	651 279	0
Perris Valley Reg. WRF (Eastern MWD)	PS AS	1.00	0.8	C & C Farms	Alfalfa irrigation	218	13
Railroad Canyon WRP (Ehinore Valley MWD)	PS AS D	0.75	0.63	Canyon Lake Country Club	Golf course irrigation	364	0
Rancho California Reg. WRF (Eastern MWD)	PS AS NR D	2.00	1.25	Quality Turf	Sod irrigation	700	(45)-13
Sun City WRF (Eastern MWD)	PS AS C F D	2.00	0.9	Cherry Hills Golf Club North Golf Course	Golf course irrigation Golf course irrigation	298 157	20
Sunnymead Reg. WRF (Eastern MWD)	PS AS	7.00	6.6	Craig Smith Herman Smith Roy Smith A & G Sod Farms, Inc. Larry Smith	Alfalfa irrigation Alfalfa irrigation Alfalfa irrigation Sod irrigation Alfalfa irrigation	1,777 1,666 414 322 107	(45)-5
Valley SD WTF	PS TF AS OP	12.10	3.5	Valley SD	Grazing irrigation	2,234	0

Note: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
SACRAMENTO							
Galt WTP, City of	OP D	0.84	0.71	Galt, City of WTP	Pasture irrigation	483	0
Rancho Murieta CSD WRP	OP DF C F D	1.50	0.4	Rancho Murieta Country Club	Golf course irrigation	169	0
SAN BENITO							
No reclamation identified							
SAN BERNARDINO							
Barstow WRF, City of	PS AS D	4.50	2.6	City of Barstow	Alfalfa irrigation	2,240	0
Big Bear Area Regional Wastewater Agency STP	AS	3.20	2.5	Farmer	Alfalfa irrigation	2,762	*
California Institution for Men-Chino STP (Dept. of Corrections)	OP	0.50	0.3	California Institution for Men	Farm irrigation	789	0
Chino Basin MWD Regional Plant No. 1 WRF	PS TF AS C F CH DC	32.00	29.2	Prado Regional Park	Landscape irrigation & recreational lakes	829	33-57
				Ontario National Golf Course	Golf course irrigation	580	
				Prado Regional Park and El Prado Golf Course	Landscape & golf course irrigation	295	
Cleghorn WTP (Crestline San Dist)	AS D	0.20	0.02	Las Flores Ranch LTD	Sudan grass irrigation	28	0
Houston Creek TP (Crestline San Dist)	PS TF D	0.75	0.34	See Cleghorn WTP	Sudan grass irrigation	362	0

Note: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
Imp Zone B STP (San Bernardino CSA 70)	PS AS D	0.25	0.20	County Service Area 70, Imp. Zone B, TP	Landscape irrigation	224	0
Kaiser Steel Resources, Inc. STP	PS TF	0.50	0.15	California Steel Industries	Steel plant cooling water	173	0
National Training Center STP	PS OP D	1.10	0.85	Fort Irwin	Alfalfa irrigation	915	0
Pilot Rock Conservation Camp STP (CA Dept of Forestry)	AS	0.01	0.01	See Cleghorn WTP	Sudan grass irrigation	9	0
San Bernardino WRP, City of	PS AS C F D	3.00	1.87	San Bernardino Golf Club Caltrans	Golf course irrigation	89	17-204
					Freeway irrigation	62	
Seeley Creek TP (Crestline San Dist)	PS TF D	0.50	0.23	See Cleghorn WTP	Sudan grass irrigation	202	0
Upland Hills Country Club WRP (City of Upland)	PS TF C F D	0.20	0.16	Upland Hills Country Club	Golf course irrigation	173	104
USMC Air Ground Combat Center STP-Twenty-nine Palms	PS OP	7.00	1.94	Air Ground Combat Center Combat Center Golf Course	Landscape irrigation	1,335	0
					Golf course irrigation	445	
Western Hills Golf & Country Club WTP	AS D	Unk	0.02	Western Hills Golf & Country Club	Golf course irrigation	21	0
Willow Creek WTP (Lake Arrowhead Comm Serv Dist)	PS AS CH	1.70	1.34	District Reclamation Farm	Alfalfa irrigation	1,473	0
SAN DIEGO							
Aquatic Treatment Pilot Plant (City of San Diego)	RS AQ C F UV RO ST CA CH	0.30	0.18	Caltrans	Freeway irrigation	10	109

Note: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
Fallbrook SD WTP #1	PS AS C F D	3.10	1.56	Caltrans	Freeway irrigation	20	268
Jamacha WTP (Otay WD)	AS C F D	1.30	0.78	San Diego Gas & Electric	Landscape irrigation	46	436
Meadowlark WRF (Vallecitos WD)	RB C F	2.00	0.5	La Costa Country Club	Golf course irrigation	38	240
San Diego Wild Animal Park STP	AS	0.04	0.01	San Diego Wild Animal Park	Landscape irrigation	14	0
San Pasqual Academy WTP	RB F D	0.50	0.5	San Pasqual Academy	Corn, alfalfa, sudan grass, eucalyptus irrigation	448	0
San Vicente WTP (Ramona MWD)	AS F RO	0.38	0.31	Solk Ranch	Avocado irrigation	350	20
Santa Maria WTP (Ramona MWD)	AS	0.60	0.52	Ramona Municipal WD	Pasture irrigation	583	*
Santee WRP (Padre Dam MWD)	PS AS OP C F D	4.00	1	Santee Lakes Regional Park and Campground	Recreational lakes	1,120	0
Sewage Disposal Plant #2 (Camp Pendleton)	PS TF AS F D	1.30	0.50	Marine Memorial Golf Course	Golf course irrigation	690	0
Viejas WPCF-Alpine (Cnty of San Diego)	AS D	0.03	0.03	Descanso Camp	Fire break, landscape irrigation	34	0
Whispering Palms WPCF	AS D	0.30	0.09	Del Rayo Racing Stables	Pasture irrigation	17	*
SAN FRANCISCO							
No reclamation identified							

Notes: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
SAN JOAQUIN							
Lockeford Comm Serv Dist WTP	OP	0.20	0.18	Farmer	Pasture irrigation	28	0
Manteca WQCF, City of	PS TF AS D	5.50	3.5	Tony Dutra	Feed, fodder irrigation	3,437	*
White Slough WPCF (City of Lodi)	PS AS CH DC	6.20	5.9	2 tenant farmers	Alfalfa, corn and pasture irrigation	2,661	0
SAN LUIS OBISPO							
Atascadero CSD STP	OP	1.40	0.97	Chalk Mountain Golf Course	Golf course irrigation	338	53
Black Lake WTP (San Luis Obispo CSA 1-G)	OP D	0.10	0.01	Black Lake Golf Course	Golf course irrigation	11	Unk
California Men's Colony STP (Calif Dept of Corrections)	PS TF C F CH DC	2.00	0.95	Cal. Poly State University	Pasture irrigation	215	0
Cambria Comm Serv Dist STP	AS CH	1.00	0.48	District disposal site	Fodder irrigation	533	0
Rancho Colina STP	AS	0.35	0.01	Rancho Colina	Pasture irrigation	11	0
San Luis Obispo WTP, City of	PS TF OP CH DC	5.20	4.5	Rancher	Pasture irrigation	31	0
SAN MATEO							
No reclamation identified							

Note: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
SANTA BARBARA							
Cachuma SD WTP	AS OP	0.22	0.03	Cachuma Trail's	Pasture irrigation	1	0
Guadalupe WTP, City of	PS OP	0.50	0.36	Charles A. Pasquini	Pasture irrigation	363	0
Laguna CSD STP	PS TF OP	3.20	2	Farmer	Pasture, fodder crops, sugar beet irrigation	2,190	(34)
Mission Hills Comm Serv Dist STP	OP	0.40	0.23	Mission Bell Dairy	Fodder irrigation	4	0
Santa Maria WTP, City of	PS TF OP	7.80	5.58	WTP pasture	Pasture irrigation	1,875	0
Solvang WTP, City of	AS D	1.00	0.68	Gardner Ranch	Pasture irrigation	37	0
U.S. Penitentiary STP - Lompoc	PS OP	0.68	0.38	U.S. Penitentiary at Lompoc	Corn irrigation	424	0
SANTA CLARA							
Gilroy and Morgan Hill STP, Cities of	OP CH	6.10	5	Hoey Christmas Tree Farm	Christmas tree irrigation	31	20
				Mario Fiorio	Flower, vegetable seed irrigation	31	
				Christmas Hill Park	Landscape irrigation	9	
SANTA CRUZ							
No reclamation identified							
SHASTA							
Shasta College WTP	OP	Unk	Unk	Shasta College	Alfalfa irrigation	6	0
Shasta Dam Area PUD STP	AS D	0.70	0.65	Wayne Gardner	Pasture irrigation	215	15
				Sierra Pacific Lumber	Wash down log decks	31	

Note: Refer to end of table for notes.

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Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
SIERRA							
Loyalton WTP, City of	PS OP	0.24	0.32	Farmer	Hay irrigation	358	0
SISKIYOU							
Montague STP, City of	OP	0.23	0.08	Meamber Ranch	Grazing, grass hay, alfalfa irrigation	116	0
Weed WQCF, City of (Shastina System)	OP	0.25	0.17	Willard Caldwell Ranch	Pasture irrigation	122	0
Weed WQCF, City of (Weed System)	PS TF OP	0.38	0.21	Roger Zwanziger	Alfalfa irrigation	153	0
SOLANO							
Fairfield-Suisun Subregional WTP	PS TF AS C F CH DC	17.50	12	Warren's Turf Nursery Suisun Marsh Hunting Preserve	Sod farming Maintenance of hunting marsh	2,240 172	5
SONOMA							
Bodega Bay PUD STP	AS F D	0.38	0.17	Bodega Harbor Golf Links	Golf course irrigation	155	*
Forestville CSD WTP (Sonoma Cnty Dept Public Works)	OP CH	0.10	0.05	Marino Crinella (Owner)	Pasture irrigation	23	0
Laguna TP (City of Santa Rosa)	PS AS C F CH	18.00	15	39 agricultural users	Fodder irrigation	9,339	(35)
Oakmont WTP (City of Santa Rosa)	AS F D	0.67	0.32	Oakmont Golf Course	Golf course irrigation	162	*

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
Occidental CSD WTP (Sonoma Cnty Dept Public Works)	OP CH	0.03	0.02	Graham's Pasture	Pasture irrigation	12	0
Petaluma STP, City of	PS TF AS OP CH DC	5.20	4.2	7 Agricultural users	Pasture, feed crops, tree irrigation	1,366	7
Russian River CSD STP (Sonoma Cnty Dept of PW)	AS F CH	0.50	0.31	Northwood Golf Course	Golf course irrigation	54	0
Sonoma Cnty Serv Area #31 STP (Sonoma Cnty Dept of PW)	OP CH	0.30	0.27	County Service Area #31 (Cnty Airport)	Fodder crop irrigation	108	0
Sonoma Valley CSD STP (Sonoma Cnty Dept of PW)	AS CH DC	3.00	2.7	Mitch Mulas	Pasture, fodder irrigation	153	0
Windsor WD STP	OP D	1.00	0.65	District disposal field Landmark Vineyards	Pasture irrigation Frost protection and irrigation	552 61	0
STANISLAUS							
Ceres WTF, City of	PS OP F D	1.80	1.80	Farmer City of Ceres	Silage irrigation Landscape irrigation	263 92	0
Modesto WQCF, City of	PS TF OP D	25.00	23.99	Modesto Water Control Facility Secondary Site	Fodder crops (corn, alfalfa, clover) irrigation	14,390	0
Patterson WTP, City of	AS	1.00	0.45	Tony Gill	Pasture irrigation	135	0
SUTTER							
No reclamation identified							

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey - 1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
TEHAMA							
Red Bluff WRP, City of	PS AS F D	2.30	1.30	Freeway Landscaping I-5	Freeway irrigation	110	35
TRINITY							
No reclamation identified							
TULARE							
Cutler-Orosi Joint Powers Wastewater Authority STP	PS TF AS CH	1.47	1.20	Altra Growers Inc. Effluent Disposal Facility	Grapes, vines, peaches, eucalyptus irrigation Winter wheat irrigation	683 669	0
Dinuba WTP, City of	PS TF OP	3.00	1.5	Dinuba, City of	Alfalfa irrigation	1,534	0
Exeter WTP, City of	OP CH	1.20	0.70	Jay Peterson	Plum irrigation	30	0
Ivanhoe PUD STP	OP	0.56	0.35	Ivanhoe PUD	Pasture irrigation	343	0
Porterville WTF, City of	AS	8.00	3.50	Farmer	Alfalfa, cotton, barley, wheat, fruit trees irrigation	1,918	2
Strathmore PUD WTP	PS OP	0.40	0.29	Wastewater Treatment Plant	Citrus, eucalyptus trees, pasture irrigation	46	0
Tulare WPCF, City of	PS TF OP	4.70	5.58	Clarklind Farms	Cotton, corn, wheat irrigation	6,248	0
Visalia WCP, City of	PS TF AS D	12.50	9.8	Mill Creek irrigation area	Non-food crop irrigation	4,861	0
Woodlake WTF, City of	OP	0.91	0.55	City of Woodlake	Pasture irrigation	621	0

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
TUOLUMNE							
Groveland Comm Serv Dist WTF	AS D	0.40	0.14	Pine Mountain Lake Country Club	Golf course irrigation	57	21
Jamestown SD WTP (Tuolumne Regional WD)	PS TF CH	0.28	0.15	See Sonora Regional WTP	Pasture, forage, fiber crop irrigation	186	0
Sierra Conservation Center STP (CA Dept of Corrections)	AS OP D	0.50	0.42	Joe Martin	Pasture irrigation	470	0
Sonora Regional WTP (Tuolumne Regional WD)	PS TF OP CH	2.60	1.2	33 users (vic. Jamestown, CA)	Pasture, forage, fiber crop irrigation	1,232	0
Tuolumne City SD WTP	PS AS OP	0.34	0.07	Baker Ranch	Pasture irrigation	101	0
VENTURA							
Camarillo SD WTP	PS AS D	6.00	3.8	Smith Ranch	Processed crop irrigation	1,648	0
Camrosa WTP (Ventura Regional SD)	PS TF OP CH	1.5	1	Camarillo State Hospital	Corn, lettuce, celery, broccoli, cauliflower, furrow crop, sprinkler pre-irrigation	307	0
				Farmer	Lettuce, corn, celery, peppers, broccoli, furrow crop sprinkler pre-irrigation	276	
San Buenaventura (Ventura) STP, City of	PS TF AS C F CH DC	14.00	10.50	Olivas Park Golf Course	Golf course irrigation	514	72
				Buenaventura Golf Course	Golf course irrigation	232	
				Ventura Port District	Landscape irrigation	9	
				Marina Park	Landscape irrigation	6	

Note: Refer to end of table for notes.

State Water Resources Control Board, Office of Water Recycling, Municipal Wastewater Reclamation Survey -1987

Treatment Plant				Reclaimed Water User	Type of Use	Annual Water Reuse (AF)	Water Price (\$/AF)
Name	Processes	Capacity (MGD)	Flow (MGD)				
Santa Paula WRF (Ventura Regional SD)	PS TF F D	2.55	2	Manuel Escalante	Citrus irrigation	117	0
Santa Susana Field Lab STP (Rocketdyne-Rockwell)	AS F	0.11	0.02	Santa Susana Field Laboratory	Cooling water for rocket flame buckets	23	0
YOLO							
No reclamation identified							
YUBA							
Sewage TP, Facility 8935 (Beale AFB)	PS TF D OP	5.00	0.85	Beale AFB Golf Course Facility 2242	Golf course irrigation	159	0
TOTAL ANNUAL WATER REUSE (AF)						266,559	

Notes:

- General:** The following entities are believed to have provided or used reclaimed water, however, no data are available to include in the survey: Armona Comm Serv Dist, Lake Don Pedro Golf and Country Club, County of Los Angeles Dept of Public Works (Malibu Mesa WRP), Pacific Lumber (Scotia), Shafter Public Utilities Dist, Sunol Valley Golf Course, and Warner Springs Ranch Resort.
- Name:** The treatment plant name as reported on survey questionnaire is generally used. If the owning agency or reclaimed water purveyor is not apparent from the plant name, it is shown in parentheses following. Occasionally for reference a plant location is appended after the plant name and a hyphen. "STP" is appended to a proper name unless another generic plant type were designated. Refer to Appendix C for list of abbreviations.
- Processes:** All processes available for treatment are shown. In some cases some processes are used only for discharge or for some users. "*" designates that secondary or other treatment has been provided at another wastewater treatment plant. Refer to Appendix C for list of abbreviations.
- Capacity and Flow:** Average dry weather flow, in million gallons per day (1 MGD = 3785.4 cubic meters/day). "Unk" designates that amounts are unknown.

Notes, continued:

- 5. Annual Water Reuse:** All amounts have been converted from million gallons to acre-feet (AF) and are rounded to the nearest whole amount except for users of less than 0.5 AF, which are rounded to the nearest 0.1 AF. (1 AF = 1233.4 cubic meters.)

- 6. Water Price:** Positive amounts shown indicate the amount paid by the user for the reclaimed water. Parentheses designate negative amounts to indicate the amount the user is paid to take the reclaimed water. The amount shown applies to all listed users for the treatment plant unless otherwise indicated by showing a range of amounts, also, ranges shown with both negative and positive limits indicate that users pay water for reclaimed water in summer and are paid the amount shown in parentheses to take the reclaimed water in winter. An equivalent unit price per acre-foot of reclaimed water has been calculated where appropriate from charges per month, year, or acre of irrigated land. An asterisk designates cases where the monies exchanged cover additional services or costs, such as land rental, and the value of the reclaimed water cannot be determined. "Unk" designates that no information is available.

Appendix C
WASTEWATER TREATMENT REQUIREMENTS
FOR REUSE

EXCERPT OF
CALIFORNIA DEPARTMENT OF HEALTH SERVICES
WASTEWATER RECLAMATION CRITERIA
CONTAINING
WASTEWATER TREATMENT REQUIREMENTS [3]

CHAPTER 3. RECLAMATION CRITERIA

Article 1. Definitions

60301. **Definitions.** (a) **Reclaimed Water.** Reclaimed water means water which, as a result of treatment of domestic wastewater, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

(b) **Reclamation Plant.** Reclamation plant means an arrangement of devices, structures, equipment, processes and controls which produce a reclaimed water suitable for the intended reuse.

(c) **Regulatory Agency.** Regulatory agency means the California Regional Water Quality Control Board in whose jurisdiction the reclamation plant is located.

(d) **Direct Beneficial Use.** Direct beneficial use means the use of reclaimed water which has been transported from the point of production to the point of use without an intervening discharge to waters of the State.

(e) **Food Crops.** Food crops mean any crops intended for human consumption.

(f) **Spray Irrigation.** Spray irrigation means application of reclaimed water to crops by spraying it from orifices in piping.

(g) **Surface Irrigation.** Surface irrigation means application of reclaimed water by means other than spraying such that contact between the edible portion of any food crop and reclaimed water is prevented.

(h) **Restricted Recreational Impoundment.** A restricted recreational impoundment is a body of reclaimed water in which recreation is limited to fishing, boating, and other non-body-contact water recreation activities.

(i) **Nonrestricted Recreational Impoundment.** A nonrestricted recreational impoundment is an impoundment of reclaimed water in which no limitations are imposed on body-contact water sport activities.

(j) **Landscape Impoundment.** A landscape impoundment is a body of reclaimed water which is used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.

(k) **Approved Laboratory Methods.** Approved laboratory methods are those specified in the latest edition of "Standard Methods for the Examination of Water and Wastewater", prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation and which are conducted in laboratories approved by the State Department of Health.

(l) **Unit Process.** Unit process means an individual stage in the wastewater treatment sequence which performs a major single treatment operation.

(m) **Primary Effluent.** Primary effluent is the effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliter per liter per hour of settleable solids as determined by an approved laboratory method.

(n) **Oxidized Wastewater.** Oxidized wastewater means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

(o) **Biological Treatment.** Biological treatment means methods of wastewater treatment in which bacterial or biochemical action is intensified as a means of producing an oxidized wastewater.

(p) **Secondary Sedimentation.** Secondary sedimentation means the removal by gravity of settleable solids remaining in the effluent after the biological treatment process.

(q) **Congulated Wastewater.** Congulated wastewater means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable flocc-forming chemicals or by an equally effective method.

(r) **Filtered Wastewater.** Filtered wastewater means an oxidized, coagulated, clarified wastewater which has been passed through natural undisturbed soils or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and any 24-hour period.

(s) **Disinfected Wastewater.** Disinfected wastewater means wastewater in which the pathogenic organisms have been destroyed by chemical, physical or biological means.

(t) **Multiple Units.** Multiple units means two or more units of a treatment process which operate in parallel and serve the same function.

(u) **Standby Unit Process.** A standby unit process is an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment for the entire design flow of the unit for which it is a substitute.

(v) **Power Source.** Power source means a source of supplying energy to operate unit processes.

(w) **Standby Power Source.** Standby power source means an automatically actuated self-starting alternate energy source maintained in immediately operable condition and of sufficient capacity to provide necessary service during failure of the normal power supply.

(x) **Standby Replacement Equipment.** Standby replacement equipment means reserve parts and equipment to replace broken-down or worn-out units which can be placed in operation within a 24-hour period.

(y) **Standby Chlorinator.** A standby chlorinator means a duplicate chlorinator for reclamation plants having one chlorinator and a multiple point chlorination. Multiple point chlorination means that chlorine will be applied simultaneously at the reclamation plant and at subsequent chlorination stations located at the use area and/or some intermediate point. It does not include chlorine application or odor control purposes.

(aa) **Alarm.** Alarm means an instrument or device which continuously monitors a specific function of a treatment process and automatically gives warning of an unsafe or undesirable condition by means of visual and audible signals.

(bb) **Person.** Person also includes any private entity, city, county, district, the State or any department or agency thereof.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13321, Water Code. Reference: Section 13321, Water Code.

History: 1. New Chapter 4 (§§ 60001-60357, not consecutive) filed 4-2-75; effective thirtieth day thereafter (Register 75, No. 14).
2. Renumbering of Chapter 4 (Sections 60301-60357, not consecutive) to Chapter 3 (Sections 60301-60357, not consecutive), filed 10-14-77; effective thirtieth day thereafter (Register 77, No. 42).

Article 2. Irrigation of Food Crops

60303. **Spray Irrigation.** Reclaimed water used for the spray irrigation of food crops shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

60305. **Surface Irrigation.** (a) Reclaimed water used for surface irrigation of food crops shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

(b) Orchards and vineyards may be surface irrigated with reclaimed water that has the quality at least equivalent to that of primary effluent provided that no fruit is harvested that has come in contact with the irrigating water or the ground.

60307. **Exceptions.** Exceptions to the quality requirements for reclaimed water used for irrigation of food crops may be considered by the State Department of Health on an individual case basis where the go extensive commercial, physical or chemical processing sufficient to destroy pathogenic agents before it is suitable for human consumption.

Article 3. Irrigation of Fodder, Fiber, and Seed Crops

§3009. Fodder, Fiber, and Seed Crops. Reclaimed water used for the surface or spray irrigation of fodder, fiber, and seed crops shall have a level of quality no less than that of primary effluent.

§3011. Pasture for Milking Animals. Reclaimed water used for the irrigation of pasture to which milking cows or goats have access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 4. Landscape Irrigation

§3012. Landscape Irrigation. (a) Reclaimed water used for the irrigation of golf courses, cemeteries, freeway landscapes, and landscaped areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 240 per 100 milliliters in any two consecutive samples.

(b) Reclaimed water used for the irrigation of parks, playgrounds, schoolyards, and other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized, coagulated, filtered wastewater or a wastewater treated by a sequence of unit processes that will assure an equivalent degree of treatment and reliability. The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 23 per 100 milliliters in any sample.

Note: Authority cited: Section 808, Health and Safety Code and Section 13581, Water Code. Reference: Section 13580, Water Code.

History: 1. Amendment filed 9-22-76; effective thirtieth day thereafter (Register 78, No. 38).

Article 5. Recreational Impoundments

§3015. Nonrestricted Recreational Impoundment. Reclaimed water used as a source of supply in a nonrestricted recreational impoundment shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

§3017. Restricted Recreational Impoundment. Reclaimed water used as a source of supply in a restricted recreational impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

§3019. Landscape Impoundment. Reclaimed water used as a source of supply in a landscape impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 5.1. Groundwater Recharge

§3020. Groundwater Recharge. (a) Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services' recommendations to the Regional Water Quality Control Boards for proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.

(b) The State Department of Health Services' recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal.

(c) The State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each groundwater recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner.

Note: Authority cited: Section 808, Health and Safety Code and Section 13581, Water Code. Reference: Section 13580, Water Code.

History: 1. New Article 5.1 (Section 00300) filed 9-22-76; effective thirtieth day thereafter (Register 78, No. 38).

Article 5.5. Other Methods of Treatment

§3020.5. Other Methods of Treatment. Methods of treatment other than those included in this chapter and their reliability features may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the method of treatment and reliability features will assure an equal degree of treatment and reliability.

Note: Authority cited: Section 808, Health and Safety Code and Section 13581, Water Code. Reference: Section 13580, Water Code.

History: 1. Reamendment of Article 11 (Section 00307) to Article 5.5 (Section 00300.5) filed 9-22-76; effective thirtieth day thereafter (Register 78, No. 38).

Appendix D

**LIST OF ABBREVIATIONS
AND CONVERSION TABLES**

LIST OF ABBREVIATIONS

AF = acre-foot
AQ = aquatic treatment
AS = activated sludge, including oxidation ditch
C = coagulation/flocculation
CA = California or carbon adsorption
CH = chlorination
Co. = Company
Comm Serv Dist = Community Services District
Cnty = County
CSD = County Sanitation District
CWD = County Water District
D = disinfection
DC = dechlorination
Dept = Department
DF = dissolved air flotation
Dist = District
F = filtration
Inc = Incorporated
Irr = Irrigation
MGD = million gallons per day
MWD = Municipal Water District
NR = denitrification
OP = oxidation ponds, including aerated lagoons
PS = primary sedimentation
PUD = Public Utility District
RB = rotating biological contactor
Reg = Regional
RO = reverse osmosis
RS = rotary screens
RWQCB = California Regional Water Quality Control Board
San = Sanitation
SD = Sanitary District
ST = air stripping
STP = Sewage Treatment Plant
SWRCB = California State Water Resources Control Board
TF = trickling filters
TP = Treatment Plant
UV = ultraviolet disinfection
W = wetlands
WD = Water District
WPCF = Wastewater Pollution Control Facility
WPCP = Water Pollution Control Plant
WQCF = Water or Wastewater Quality Control Facility
WQCP = Water Quality Control Plant
WRF = Wastewater Reclamation Facility
WRP = Water Reclamation Plant
WTF = Wastewater Treatment Facility
WTP = Wastewater Treatment Plant
yr = year

CONVERSION TABLES

Volume

Cubic Feet (ft ³)	Gallons	Acre-feet (AF)	Cubic Meters (m ³)
1	7.480520	2.2957×10^{-5}	0.028317
0.13368	1	3.0689×10^{-6}	0.0037854
43560	325850	1	1233.5
35.315	264.17	8.1071×10^{-4}	1

Example: 1 ft³ = 7.480520 gallons

Flow Rate

Cubic Feet Per Second (cfs)	Gallons Per Minute (gpm)	Million Gallons Per Day (MGD)	Acre-feet Per Year (AF/yr)	Cubic Meters Per Day (m ³ /d)
1	448.83	0.64632	723.97	2446.6
0.0022280	1	0.0014400	1.6130	5.4510
1.5472	694.44	1	1120.1	3785.4
0.0013813	0.61996	0.00089274	1	3.3794
0.00040873	0.18345	0.00026417	0.29591	1

Example: 1 AF/yr = 3.3794 m³/d

"California Municipal Wastewater Reclamation in 1987"
ERRATA
August 1990

1. Tables 1 and 12, Figure 1: Users applying reclaimed water to more than one type of use are included in the "Miscellaneous...or mixed types of above uses" category in Table 1. Where a predominance of use could be presumed, the volumes of those users are included in the predominant category in Figure 1 and Table 12.
2. Page 10, third paragraph: "Tables 2 and 6" should read "Tables 3 and 7".
3. Appendix B: The subheadings in the table in Appendix B are county names.
4. Page 60, Appendix C: The correct reference for this excerpt is [4] rather than [3].